PARTS OF THE ORIGINAL DOCUMENT

ARE OF POOR REPRODUCTIVE QUALITY

CERTAINES PARTIES DU DOCUMENT ORIGINAL

SONT DE PIÈTRE QUALITÉ DE REPRODUCTION

ENVIRONMENTAL IMPACT STATEMENT

ROSS BAY JUNCTION - CHURCHILL FALLS TOTE ROAD

TRANSPORTATION

GOVERNMENT OF NEWFOUNDLAND & LABRADOR

ADDENDUM

ENVIRONMENTAL IMPACT STATEMENT

ROSS BAY JUNCTION - CHURCHILL FALLS TOTE ROAD

PURPOSE

The purpose of this Addendum is to clarify any inconsistencies and augment the data base presented in the Environmental Impact Statement for the Ross Bay Junction - Churchill Falls Tote Road. The information is structured so as to be readily merged with the original Environmental Impact Statement.

Section 1.1 The Environmental Impact Statement

This Environmental Impact Statement is for one element of what will ultimately be the Trans Labrador Highway.

The Tote Road design is significantly compatible with the eventual design standards of the Trans Labrador Highway as to be viewed as a staged construction. The EIS clearly defines three evolutions for the Trans Labrador Highway:

i) seasonal Tote Road

ii) Trans Labrador Highway (TLH)

and iii) TLH connected to North America

The environmental impact analysis covers all evolutions to ensure future upgrading of the road corridor would not entail new significant environmental implications.

Section 1.3.2. The Objectives

In 1979, an interdepartmental, multi-disciplinary task force prepared a draft master plan for Labrador under the terms of the Canada/Newfoundland Subsidiary Agreement on Planning. At this time the Trans Labrador Highway as documented in the R.J. Noah report was accepted as a provincial priority. Funding was provided for the design of the roadway between Goose Bay and Gull Island in preparation of anticipated hydro-electric developments.

Subsequently, the Executive Council successfully negotiated funding for the highway from the Federal Government under the terms of the Special Capital Recovery Program. This funding was applied to the construction of a Tote Road from Wabush to Ross Bay Junction. In addition, based on the recommendations of ADI in their 1984 report "Newfoundland Highway Prospective Analysis" further Federal funding was negotiated under the terms of the Economic and Regional Development Agreement.

"Managing All Our Resources", the official Development Plan for Newfoundland and Labrador issued over the signature of the Premier in October 1980, makes reference on page 114 under Objectives and Goals of:

> "Labrador transportation development, particularly a Trans Labrador Highway"

and continues on page 115:

> The Trans Labrador Highway is a major priority. Design work is now complete on the section from Goose Bay to Gull Island and a proposal has been made to DREE to start construction on a section of road from Wabush/Labrador City eastward towards Churchill Falls. With federal government co-operation, the next five years should see substantial progress towards a highway across Labrador. Such a major addition to our transportation network will have obvious benefits for Labrador and contribute greatly to social and economic development in the entire Province.

The province remains committed to a multi-modal transportation infrastructure; rail, air, marine, and road are to be provided whenever and wherever necessary. Thus the Trans Labrador Highway, of which the Ross Bay Junction - Churchill Falls Tote Road forms a component, is provincial policy at the highest level.

Resource development in Labrador is widely scattered. Little in the way of forest, mineral, or hydro electric resources are directly located within the study area of the Ross Bay Junction - Churchill Falls Tote Road. Rather, these resources will be provided a basic road corridor from which access to site specific resources may be developed at a future date.

Section 3.1.2 Surficial Geology and Soils

The Aggregate Resource Maps available from the Mineral Development Division of the Department of Mines and Energy were examined for determination of aggregate resources within the preferred and alternate route study corridors. Map numbers 83-20, 83-21, and 83-22 were reviewed. The corridor shown on these maps does not coincide with the study corridors along the two study routes. There was some minor overlap; however, only at two locations. For this reason, the aggregate resource maps could not be utilized.

Northland Associates Limited determined the type and boundaries of aggregate resources within the preferred and alternate route study corridors by interpretation of 1:50,000 aerial photos and from a review of the geological studies of Fulton et al (1974) and Greene (1974). The reader is referred to page 1 of the Biophysical Classification, Appendix E. The area (in hectares) of potential aggregate resources within the study corridors is indicated in the attached two tables. Each area relates to a specific ecosystem number developed in the ecological land classification of the study corridors. The reader is referred to the ecosystem maps Appendix E (maps E-1 to E-9 for the preferred route and E-1 to E-6 for the alternate) which were derived using the Ecological Land Classification System as discussed in the guidelines for mapping by Lacate (1969).

The clear commitments of the Department of Transportation with respect to the development and rehabilitation of aggregate resource areas is outlined in Section 6 - Mitigation, Section 7 - Monitoring, and Appendix F which contains the specifications currently in use by the Department.

Section 3.1.5 Wildlife Resources

Based on the field work carried out in 1984-85, the analysis of the seasonal distribution of the caribou of Western Labrador suggests that a reasonably discrete herd of caribou occupied the area described by the quadrangle Esker-Elizabeth River-Lac aux Sauterelles and Lac Opocopa. There was little variation in the seasonal distribution shown by the Lac Joseph Herd which occupied this area and as a result it appeared that the calving, summer, fall and winter ranges of the herd were overlapping. During the 1984 calving season, caribou did not appear to concentrate on a common calving ground and no major calving area was located. No specific rutting areas or areas with high concentration of caribou were located during the rutting season. The caribou appeared to aggregate in late winter while they remained relatively solitary during the calving season. The 1985-86 field work should shed more light on the seasonal distribution of the Lac Joseph Caribou.

The potential expansion of the Georges River caribou herd into the study area would only be possible if the animals establish migration/movement patterns across the existing transportation facilities in Labrador, viz the QNSLR, the Esker Road, and the Freedom Road. These facilities are between our proposed roadway and the core area of the Georges River herd. As our facility would provide no greater barrier the impact on this potential expansion should be minimal.

Section 3.2 Social Environmental Setting

No account will or can be taken of the few Quebec based Innu who may continue to use the study area. These people refuse to participate in the environmental assessment process and, in the main, have reduced their use of the study area since Federal subsidies no longer apply to interprovincial air travel and Newfoundland regulations require non-resident hunting permits.

An intimate dialogue between the various project consultants; Native Resource Use, Public Participation, Socio economic, and Tourism; established the 40/60 split in Sheshatshui.

Section 3.2.2 Socio-Economics (The Innu)

It is recognized that the cultural aspects of the Innu community are rooted in their hunting and land use patterns. With any development in Labrador these cultural aspects will be affected. The preferred road corridor according to our consultant provides less impact than the alternate. Mitigative measures have been proposed to offset the potential impacts on Innu hunting and land use.

Section 3.3.2 The Market

The tourism contribution to the Labrador economy is highly significant being in the order of $3 million during summer months based on 1984 data.

Section 4.1.1 Do Nothing

The "do nothing" alternative does not exacerbate either the Innu or the caribou concerns documented elsewhere in the report. There exist no other valid transportation alternatives to move people and freight conveniently, comfortably, and efficiently accross Labrador

Equally, in addition to failing to meeting socio economic development concerns expressed in the EIS, failure to construct a Trans Labrador Highway abrogates provincial policy.

Section 4.1.2 Rail Link

In order to provide rail service between Goose Bay and Wabush, a distance of some 610 kilometres, a vehicle consist is required. Two trains, each of 70 cars, require 1 caboose each as per federal legislation. Power is supplied by one locomotive each with a third in reserve to assist in climbing hills and to act as a replacement when a power unit is out of service.

Section 4.1.3 Roadway

As referenced in the Bibliography this section is based on the 1974 report by R.J Noah and Associates "The Quebec - Trans Labrador Highway". The Ross Bay Junction - Churchill Falls Tote Road will form part of the Trans Labrador Highway as documented on page 1-3 of the EIS. While the Noah report makes reference to the various resources accessed directly or indirectly by a Trans Labrador Highway, the EIS documents the conditions within a 5 kilometre study corridor for a small portion between Ross Bay Junction and Churchill Falls.

Section 4.1.4 Summary

A roadway alternative would conflict with Innu use of portions of the study area and may have some effect on the Lac Joseph caribou herd. The proponent accepts these potential impacts, however, places them below the objectives for Labrador transportation:

- to reduce the isolation of the area of Labrador City/Wabush;
- to encourage job growth;
- to improve Happy Valley/Goose Bay's position as an entry point for goods to Western Labrador;
- to encourage additional resource development in the hydro electric power, forestry and mining sectors and;
- to provide at least the minimum requirements for a surface transportation network for the major communities of Labrador.

Section 4.2.3 Financial Evaluation of Design Alternatives

Should the alternative route be chosen the Department of Transportation would provide maintenance for the entire route, however, as Table 4.2.2.1 indicates the cost analysis is based on "new road sections, summer only". This assumption effectively includes a cost sharing of maintenance with CFL Co.

The financial analysis of the transportation economics is presented in traditionally acceptable format. The additional cost of constructing the alternative route over the proposed route would be $3.98 million with traffic volumes of 50 per day and $4.77 million with traffic volumes of 100 per day.

The financial analysis is not a cost/benefit analysis but rather a comparison of financial costs.

Section 5.2.1.2 Other Wildlife

The impact of increased hunting on Canada Geese at Ossokmanuan Lake was discussed with officials of the Canadian Wildlife Service and the Provincial Wildlife Division. Neither of these agencies showed any alarm or serious concern for the potential impact on the Canada Goose population near the proposed crossing at Ossokmanuan Lake.

Migratory bird hunters can now get to Ossokmanuan Lake via an existing access road between the Twin Falls Road and the Esker Road. This road terminates at the Ossokmanuan Lake structure. The preferred Ross Bay Junction to Churchill Falls Tote Road would permit hunters especially from Labrador West to access this area more easily.

Section 6.1 Development of a Resource Management Plan

Although the Wildlife component consultant feels that the construction of the alternate route is the only acceptable mitigative measure to prevent illegal hunting of the Lac Joseph Caribou, the proponent maintains that the development of a comprehensive resource management plan with specific emphasis on caribou will minimize any impact on the Lac Joseph Herd and therefore permit the construction of the preferred route.

Section 6.2.5 Ossokmanuan Lake

Design and construction details for the causeway and bridge structure at Ossokmanuan Reservoir are preliminary at this time. A combination bridge and causeway between km 160-163 is planned. The Department of Fisheries and Oceans will be consulted for input into the design and construction procedures following approval of the project through the environmental assessment process. The Canadian Coast Guard must also give approval of the Ossokmanuan crossing by virtue of the Navigable Waters Protection Act. This is the normal operating procedure followed by Department of Transportation.

Section 6.2.6 Borrow/Fill Material

Any organic material grubbed from a borrow site shall be stockpiled and used to rehabilitate the area prior to abandonment or as work progresses.

A slope of one quarter horizontal to one vertical is proposed for rock quarries. This specification is referenced in Appendix F. The proponent does not expect such slopes to pose any environmental hazard in the remoteness of Labrador.

Appendix E

Map 1 and 3 referred to in the list of Figures and Maps, Appendix E should be referred to as maps E-1 to E-9 for the preferred route and maps E-1 to E-6 for the alternate route respectively. The reference to map 2 should be deleted and the asterisk note at the bottom of the page should be ignored.

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF TRANSPORTATION

ST. JOHN'S

Office of the Minister
Telephone 737-3641

File No. PR/71

MAR 11 1986

Honourable John Butt, M.H.A.
Minister,
Department of Environment
Elizabeth Towers
100 Elizabeth Avenue
St. John's, NF
A1C 5T7

Dear Colleague:

RE: Environmental Impact Statement - Ross Bay Junction to Churchill Falls Tote Road Environmental Assessment

In accordance with Section 10 (1) of the Environmental Assessment Regulations, 1984, I am enclosing fifty (50) copies of the Environmental Impact Statement for the Ross Bay Junction to Churchill Falls Tote Road Environmental Assessment. This report was prepared by DeLCan De Leuw Cather Canada Limited.

The views and recommendations presented herein represent the policies and procedures of the Department of Transportation for this project.

The information contained in this report relates specifically to the Environmental Impact Statement (EIS). In addition to the EIS, there are seven (7) component studies. Any views or comments which are expressed about the component studies should consider the Environmental Impact Statement which, in addressing the overall environmental impacts of the proposed project as documented in the component studies, will provide the clear statement of the policies and procedures of the Department of Transportation with respect to this project.

(......./2)

My department looks forward to your review and examination of the Environmental Impact Statement.

If you have any questions, please do not hesitate to contact me or my staff.

Sincerely,

RON DAWE
MINISTER OF TRANSPORTATION

/dm
Enclosures

ROSS BAY JUNCTION - CHURCHILL FALLS
TOTE ROAD
ENVIRONMENTAL IMPACT STATEMENT

Prepared for the
Department of Transportation
St. John's, Newfoundland

By
ENVIRONMENTAL SYSTEMS GROUP OF
DeLCan, (De Leuw Cather, Canada Ltd.)

March 1986

06-1453-C02

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EXECUTIVE SUMMARY

1. The Undertaking

The Ross Bay Junction to Churchill Falls Tote Road will connect the road from Wabush to the road from Churchill Falls. The two alternative routes under study were:

(a) Ross Bay Junction to Churchill Falls ± 130 km (the proposed route)
  - new construction 130 km

b) Ross Bay Junction to Churchill Falls via Esker 190 km (the alternative route)
  - new construction ± 90 km
  - upgrading ± 100 km

A preliminary alignment was selected for each alternative and a 5 km wide corridor, centered on the alignment, was studied to establish the optimum location for each route.

The estimated cost is $47,200,000 for the proposed route and $50,000,000 for the alternative. Construction and upgrading should be completed in 7 years. The Tote Road is proposed as a seasonal road in operation from the end of spring break up to early fall when snow depth prohibits its use.

2. The Objective

At present, the communities of Labrador are linked to each other and to the rest of the world by air, rail and marine transportation systems only.

Road links are discontinuous, i.e., a road/rail/road trip is required to reach either the Quebec North Shore or the Lake Melville Region from the communities in Western Labrador and Churchill Falls. All such trips require a significant amount of mobilization on the part of the users. Surface links to the Lake Melville area are limited to a seasonal operation dependent on the usability of the Freedom Road from Churchill Falls to Goose Bay.

The provincial Department of Transportation (DOT) recognized that the basic social needs of the people of Labrador were not being adequately met by the existing modes of transportation. This project would be one major step in improving the Labrador transportation network.

3. The Environmental Assessment Requirement

In compliance with the Environmental Assessment Act (1980), the DOT registered the project, prepared terms of reference in 1983 and commenced the environmental assessment study in January 1985. Seven component studies, with separate Terms of References, were also initiated. These were:

- Aquatic Resources
- Wildlife Resources
- Soil/Vegetation/Geology
- Socio-Economics
- Tourism-Recreation
- Historic Resources
- Public Participation

Five consultants were retained to conduct those specialized studies under the technical and administrative direction of DeLCan, (De Leuw Cather Ltd.).

The Environmental Assessment process required that DOT prepare an Environmental Impact Statement which would describe:

- the project's needs and justification
- the background conditions in the study area
- the alternatives to the undertaking, i.e., options other than the road and the analysis leading to a preferred option

- impact of the project during and after construction on the environmental components listed above, and
- a mitigation and monitoring program where required and
- as separate documents, provide all the component studies.

4. Existing Conditions

a) Natural Environment

The study area located in West Central Labrador has a fairly uniform natural environment with no known unusual, rare or especially sensitive sites. The aquatic resources are abundant with a number of stream crossings (culverts to bridges) required for either road alternative. The dominant sport fish species found in these waters were land-locked atlantic salmon and brook trout, both common to the area. One sensitive spawning river was noted on the alternate route. Fish harvesting in the area is, at present, minimal.

The wildlife study focused on the Lac Joseph caribou herd which was found to be in a dangerously unstable condition. It appeared that the population was declining and was now at about 223 animals (down from 3,000 plus in 1975). The cause for this decline, although not definitively verified, was a result of excessive hunting and encroachment on habitat. Marten, Canada geese and ptarmigan were the other regularly harvested wildlife: presently showing no signs of being over-utilized.

b) Human (Social) Environment

In general, the socio-economic conditions in the study area reflect the region's dependence on natural resource extraction and its remote location relative to the sources of goods and services.

The land, for the most part, is owned by the crown with several holdings leased to CFL Co. There are also a number of cabins in the area. The Innu have used the area for centuries for hunting and trapping.

The study area presently supports a young population with more than 70% between the ages of 0 to 24 (for most communities) compared to the provincial average of 49%. A wide economic and socio-cultural gap exists between the Innu and Non-Innu residents creating well known problems in this region of Labrador.

Transportation costs are significantly higher than for the Newfoundland island residents. Public transportation is limited, expensive and very time consuming.

The basic problem is that volume of traffic and movement of goods is not high enough for "reasonable" profits. Few new transportation services are established and the highly subsidized major carriers are not in a position to upgrade their level of service.

The tourism "plant" in the study area is relatively small with 4 hotels reporting a 30-40% occupancy rate. The existing tourism market is small with an estimated 19,000 ± tourist trips taken in 1983. However, the tourism dollar (and multiplier effect) generated by this activity is high ($3,091,000) relative to the total economy for this area.

Native resource use has been identified as a major issue for this assessment as the proposed roadway would traverse the area used today and for hundreds of years past as a hunting and trapping area by the Innu.

An archaeological survey of the area revealed very few detectable signs of pre-historic or historic activity.

4. Impacts

a) Natural Environment

The major impact on the natural environment would be the encroachment of human development on the "core habitat" of the Lac Joseph caribou herd.

Secondly, the road would serve as new access to the fish and wildlife resources along the road putting, if permitted, excessive pressure on the fish, waterfowl, upland game and large mammals found in the study area.

Thirdly, without a carefully implemented and monitored erosion prevention program, contamination of water supplies from siltation could be a serious problem.

Finally, the improper operations of the construction camps, principally the collection and disposal of solid and liquid (sewage) wastes, could lead to serious local contamination both in terms of biological concerns and aesthetics.

b) Human (Social) Environment

Impact on the socio-economic and tourism-recreation areas would be positive in that the road would generate, albeit very slowly, revenue by improving and extending the access to Labrador's interior for the province's residents and non-residents.

The potential exists for serious negative effects on the native (Innu) resource use as the area traditionally used by the Innu (non-mechanized) would now become an area where competition from recreational trappers and hunters, with major economic advantages could restrict Innu use and potentially harvest a disproportionally high percentage of the available wildlife. The Innu being subsistence users of this resource depend on it for their food and income.

c) Long Term Protection

Road scenarios dealing with an all season road and a road connected to the national highway system were also examined to highlight any obvious future concerns. Major impacts on the natural environment would continue to be human encroachment needing sensitive pro-active environmental management policies.

Human (Social) Environment effects would be most obvious with respect to native resouce use and the uncontrolled harvest and use of the natural resource vital to the survival of the Innu. A carefully prepared resource management plan (see Item 5) should go a long way toward successfully mitigating this problem.

5. Mitigation & Monitoring

Because the impacts identified in the study cannot be addressed in isolation, the principal mitigation measure being recommended is that the Department of Forest Resources and Lands prepare a comprehensive Resource Management and Land Use plan which would place controls on resource use and land occupation within the study area. In addition to the government agencies, representatives from all Labrador interest groups, including the Innu, would be asked to participate in the preparation of such a plan.

The DOT also recommended that in order to protect the road area during the preparation of the plan (while the road is under construction), it be declared as a "Protected Road" under the provincial statutes.

Finally, DOT recommended that compliance monitoring and effects monitoring be undertaken and that the DOT Project Engineer/Environmental Planner be responsible for preparing monthly and annual compliance monitoring reports which would be available for inspection.

Summary

The impact statement and the component reports comprise a 10 volume study on the Tote Road. The authors have suggested that the principal impacts would be related to the Lac Joseph caribou herd survival and the change in land use pattern relative to the Innu. The proposed mitigation measure namely a comprehensive resource management and land use plan would be a major step toward preventing potential long term severe negative impacts stemming from new access to the natural resources.

1. INTRODUCTION AND BACKGROUND

1.1 The Environmental Impact Statement

The concept of a modern Trans Labrador Transportation system has been proposed by the provincial government for at least 25 years. This Environmental Impact Statement is for one element of what will ultimately be the Trans Labrador Highway. The Newfoundland Department of Transportation (DOT) has commissioned DeLCan Ltd. to prepare an Environmental Impact Statement for the Ross Bay Junction to Churchill Falls Tote Road project. The work has been carried out according to the Terms of Reference prepared by DOT to meet the requirements of the Environmental Assessment Act (Revised Statutes of Newfoundland 1980) and its regulations and contemporary environmental impact assessment practices for a roads project in isolated areas.

To date, the Department of Transportation, the Proponent has fulfilled the following requirements of the Environmental Assessment Process:

- Registration; the DOT registered the Undertaking in March 4, 1983.
- Examination; the Minister of Environment publicly announced the registration on March 7, 1983 and invited written comments by the public.
- Ammended registration submitted by DOT in early June 1983.
- Minister's Decision; The Department of Transporation is required to provide a complete Environmental Impact Statement August 11, 1983.
- Terms of Reference; over the period, October 3, 1983 to February 17, 1984, the Department of Transportation prepared a Terms of Reference for the Environmental Impact Statement. The Minister of Environment approved the Terms of Reference on May 23, 1984. The following seven component studies, each with their own Terms of Reference, were also approved:

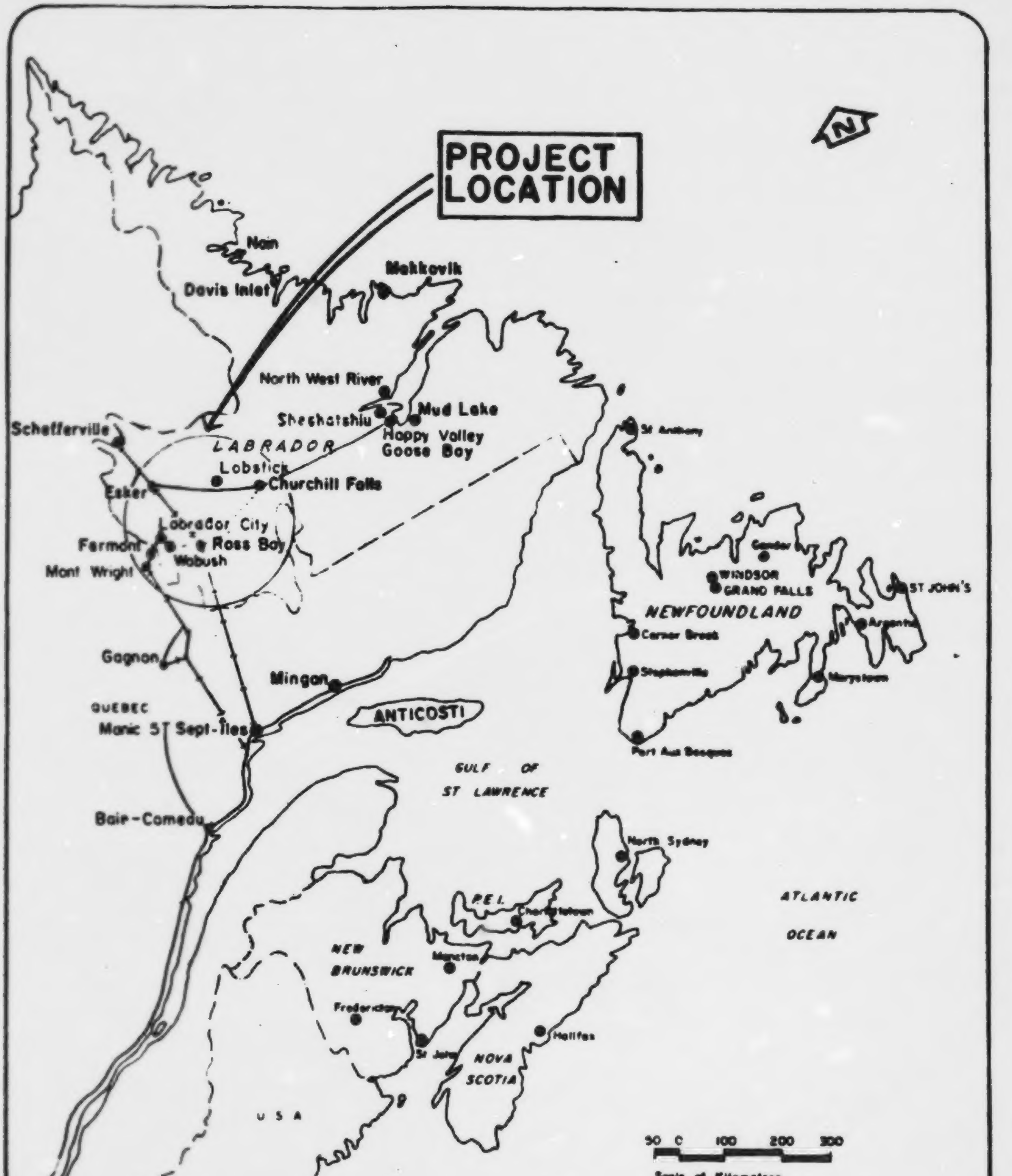
- Aquatic Resources Study
- Historic Resources Study
- Wildlife Study
- Socio-Economic Study
- Native Resource Use Study
- Tourism and Recreation Use of Natural Resources Study
- Public Participation & Information Program

- Consultant selection: The Department of Transportation called for proposals from qualified Environmental Impact Assessment Consultants on September 17, 1984. Consultants were selected to do the work in December of 1984. Work on the project commenced in January 1985 with the completion of the Component Studies and their evaluation in March of 1986.
- Public Participation and Information sessions occurred throughout Labrador in February and March 1985 and September 1985.

Further details with respect to the Environmental Assessment Process in Newfoundland and Labrador is provided in Appendix A. The Terms of Reference for the studies are included as Appendix B.

1.2 Project Location

The proposed Ross Bay Junction to Churchill Falls Tote Road is located in Western Labrador (Figure 1.2.1). The study area is generally bounded by the triangle created by the proposed route, the alternate route and the Esker Road (Figure 1.2.2). For the purpose of detailed work, a 5 km corridor centered on on each alignment was designated for both the alternate and proposed routes. Appendix C contains the expected road alignments at a scale of 1:50,000 for both the proposed and alternate route. This set of maps also includes the location of major stream crossings, proposed sites for construction work camps, borrow pits and maintenance depots.


N
PROJECT LOCATION
Nain
Makkovik
Davis Inlet
North West River
Sheshatshiu
Mud Lake
Happy Valley
Goose Bay
Schefferville
LABRADOR
Lobstick
Churchill Falls
Esker
Labrador City
Fermont
Ross Bay
Wabush
Mont Wright
Gagnon
Mingan
QUEBEC
Manic 5
Sept-Iles
ANTICOSTI
Baie-Comeau
St Anthony
Gander
WINDSOR
GRAND FALLS
ST JOHN'S
NEWFOUNDLAND
Corner Brook
Stephenville
Argentia
Marystown
Port Aux Basques
GULF OF ST LAWRENCE
North Sydney
P.E.I.
Charlottetown
ATLANTIC OCEAN
NEW BRUNSWICK
Moncton
Fredericton
St John
Halifax
NOVA SCOTIA
U S A
50 0 100 200 300
Scale of Kilometres

ROSS BAY JUNCTION - CHURCHILL FALLS TOTE ROAD

Figure 1.2.1 - PROJECT LOCATION

TRANSPORTATION

The component studies were not restricted to this area as, for example, an understanding of the extent of the caribou range or the Socio-Economic and Native Resource issues required consideration of the land and inhabitants resident in the areas both adjacent and sometimes remote from the actual project location.

During the January 1985 workshop (see Section 2.2) it was decided to address several time periods when making future impact predictions. The three time periods were:

- during construction
- 2 years post construction
- 10 years post construction

Furthermore, the client consultant team decided to address three scenarios concerning the use of the proposed roadway.

- roadway as a summer seasonal road only
- road as a year-round used and serviced facility
- roadway linked to national highway system

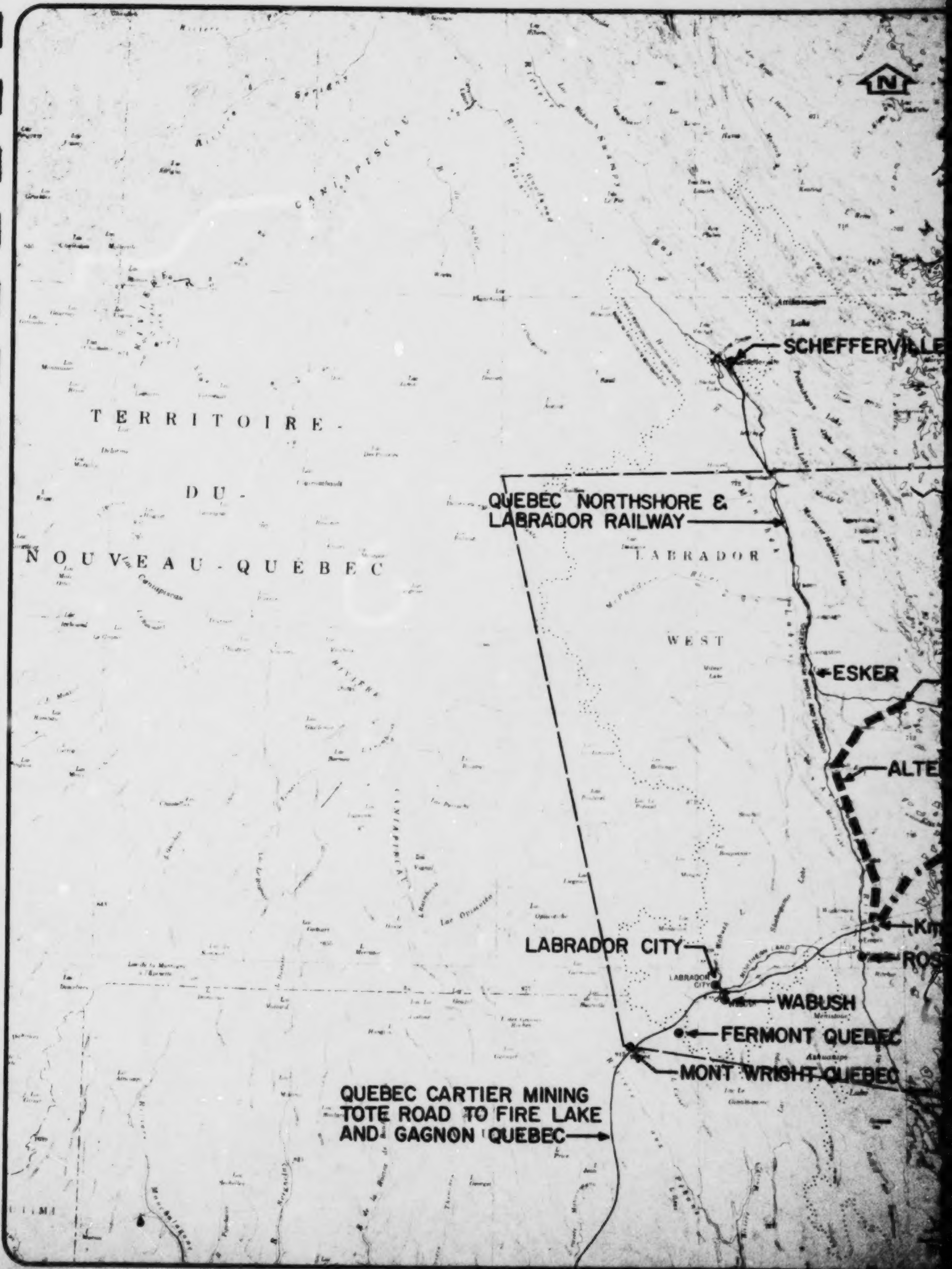
The intention was to provide some commentary concerning the future effect of the roadway for the next two likely upgradings planned for the road and to flag any significant future impacts.

1.3 Purpose of the Undertaking

1.3.1 The Problem

At present, the communities of Labrador are linked to each other and to the rest of the world by air, rail and marine transportation systems only.

Road links are discontinuous, i.e., a road/rail/road trip is required to reach either the Quebec North Shore or the Lake Melville Region from the


N
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NOUVEAU-QUEBEC
QUEBEC NORTHSHORE &
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LABRADOR
WEST
ESKER
ALTE
LABRADOR CITY
LABRADOR CITY
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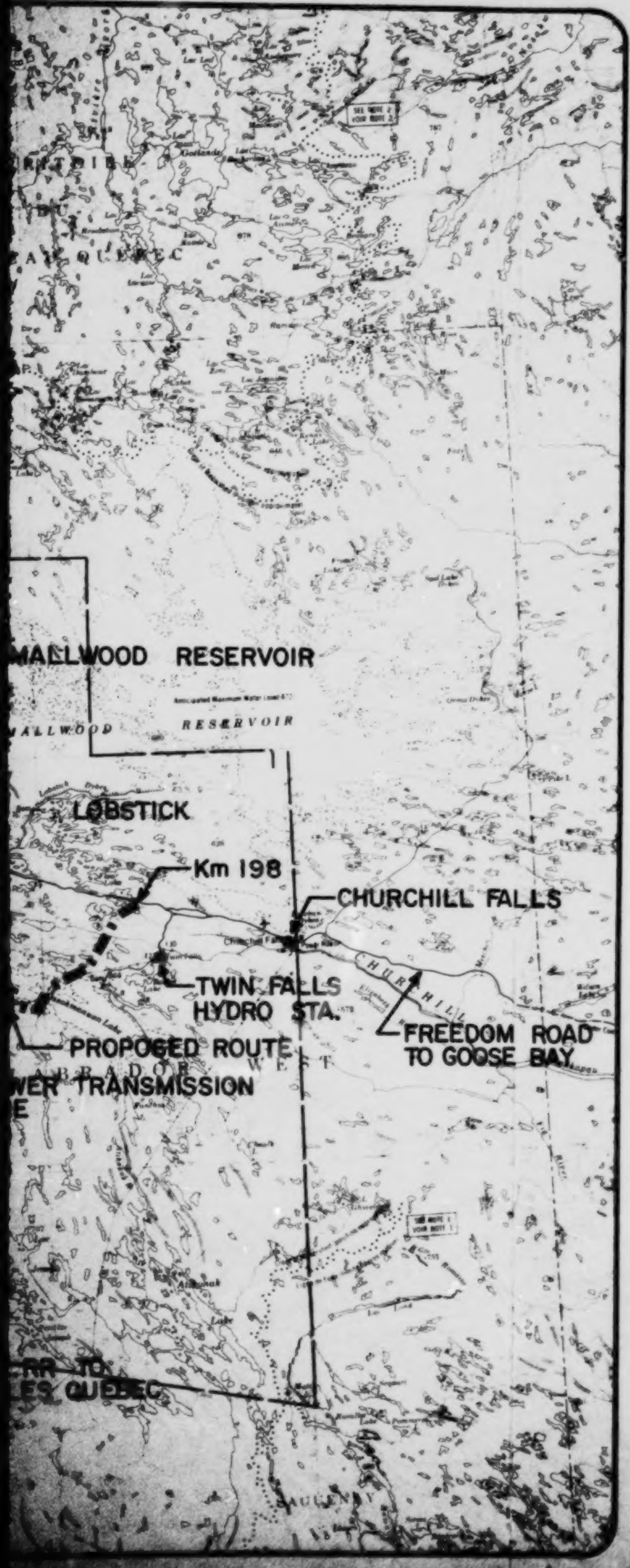
WABUSH
FERMONT QUEBEC
MONT WRIGHT QUEBEC
QUEBEC CARTIER MINING
TOTE ROAD TO FIRE LAKE
AND GAGNON QUEBEC


SMALLWOOD RESERVOIR
LOBSTICK
Km 198
CHURCHILL FALLS
TWIN FALLS
HYDRO STA.
FREEDOM ROAD
TO GOOSE BAY
PROPOSED ROUTE
WER TRANSMISSION
E
RR TO
LES QUEBEC

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

— — — — — WILDLIFE STUDY AREA

FIG. 1.2.2 STUDY AREA

SCALE 1:1,550,000

10 5 0 10 20 30 40 50 KM

DATE: 86 02 06

CONSULTANT: DeLCan TRANSPORTATION

communities in Western Labrador and Churchill Falls. All such trips require a significant amount of mobilization on the part of the users. Surface links to the Lake Melville area are limited to a seasonal operation dependent on the usability of the Freedom Road from Churchill Falls to Goose Bay.

The provincial government recognized that the basic social needs of the people of Labrador were not being adequately met by the existing modes of transportation. These roads in fact serve principally resource development and exploitation needs on a local scale and not the general public.

1.3.2 The Objectives

The objectives of this undertaking are clearly stated in one of the early studies on the Quebec-Trans Labrador Highway (Noah, 1974).

> Apart from resource development and overall transportation system efficiency, the basic social needs of the isolated populations must be fulfilled. The concept of basic link or "rock-bottom" service is subjective and does not hinge entirely upon economic criteria. For example, (1) the basic link for an isolated small population node may be regular (weekly) year-round air transport; but, (2) the basic link for an isolated large population node may be frequent (daily) year-round air transport plus highway access. It is not to be expected that every basic link will pay its way, at least at this point in time, but the proposed highway will enable such basic link services to be provided more readily and more economically than at present (Noah, 1974,P.6).

Noah, (1974) further stated that the proposed Trans-Labrador highway must be envisaged as having not only regional implications but also broader impacts as part of the national transportation development plan. For the island of Newfoundland, a highway would provide a second east-west link as an alternative to the Gulf Ferry bottleneck. The highway would thereby also provide a motor vehicle travel route bringing traffic from central Canada and the U.S.A. into central Labrador and permit a road-return through the Maritime provinces. The highway and its branches to the southern Labrador coast would represent a manifesto of national interest in the North Atlantic coastal regions and their offshore resources (Noah, 1974).

ADI (1984), in their highway needs study for the Federal Department of Transport indicated that their examination of existing justification reports and interviews with representatives of the Newfoundland Department of Mines, Municipal Affairs and the Inter-Governmental Affairs Secretariat yielded the following rationale for the Tote Road;

- to reduce the isolation of the area of Labrador City/Wabush;
- to encourage job growth;
- to improve the Happy Valley/Goose Bay's position as an entry point for goods to Western Labrador;
- to encourage additional resource development in the hydro electric power, forestry and mining sectors and;
- to provide at least the minimum requirements for a surface transportation network for the major communities of Labrador.

1.4 The Undertaking

The Ross Bay Junction to Churchill Falls Tote Road will connect the road from Wabush to the road from Churchill Falls. The two alternative routes under study were:

(a) Ross Bay Junction to Churchill Falls ± 130 km (the proposed route)
  - new construction 130 km

(b) Ross Bay Junction to Churchill Falls via Esker 190 km (the alternative route)
  - new construction ± 90 km
  - upgrading ± 100 km

A preliminary alignment (Appendix C) was selected for each alternative and a 5 km wide corridor, centered on the alignment, was studied to establish the optimum location for each route.

The estimated cost is $47,200,000 for the proposed route and $50,000,000 for the alternative. Construction and up grading should be completed in 7 years. The tote road is proposed as a seasonal road in operation from the end of spring break up to early fall when snow depth prohibits its use.

1.4.1 Road Standards

On the selected route, the horizontal alignment will be designed to an RCU80 (Rural Collector Undivided 80 km/h, RTAC, 1976) standard. This is the equivalent of the standard to which the Wabush to Ross Bay Junction road has been built. In its paved form it would be the same standard to which the Labrador City to Fermont highway has been constructed.

Streams crossing under the road will be carried in the appropriately sized corrugated metal pipes or corrugated metal arches. The arch shaped culverts will be installed to prevent any serious disturbance to the especially significant streams.

Major streams or rivers will be crossed by constructing concrete bridges as required. Bridge crossings are anticipated at three locations on the proposed route and five locations on the alternate route:

Further details concerning the design of the alternatives have been included in section 4.2.

1.4.4 Construction Scheduling

The construction year is based on the period from June to October during which it is expected that the construction areas would be ice free.

1.4.5 Labour Requirements

For each road construction contract, contractors would employ approximately 30 people for the road work and an additional 10 people for each bridge.

For summer maintenance purposes permanent depots will be established at Ross Bay Junction, km 68 and at km 174 on the proposed route or km 157 on the alternate route. Each depot would employ, on a seasonal basis, about 12 people. Winter maintenance, if applicable, would require the establishment of an additional depot at km 138, on the proposed route, or km 110 on the alternate route.

1.5 Related Studies

Three major studies were carried out with respect to providing an east-west surface transportation link across Labrador. In 1974, Noah, (1974) carried out a benefit/cost study of a proposed route from Baie Comeau, Quebec to the Strait of Belle Isle via the major Labrador Communities. This report showed a net benefit (on a value added basis and a government account basis) of a highway project for Labrador and suggested that a road was the viable alternative.

In 1980, a study of the possibility of using a Trans Labrador Railway (DeLCan, 1980) as a transportation link was prepared. The Department of Transportation concluded that on the basis that the Iron Ore Company of Canada and Wabush Mines had no interest in a new rail line (they have their existing rail and present facilities at a year round port on the Quebec North Shore) and with capital costs of $1,258.7 million (1980 Canadian dollars) and projections that at least 20 million tons of ore would have to be hauled annually to cover only 5% of the capital costs, the project was not a viable method of providing a surface transportation link across Labrador.

In 1984, the Ministry of Transport (Canada) commissioned a study on Road Needs (ADI 1984). While the study did not re-evaluate the Quebec-Trans Labrador Highway Concept in detail, it did indicate that the net present value of the Tote Road was positive at a 10% discount rate and that the proposed route between Ross Bay Junction to Churchill Falls be followed as "it offers greater transportation efficiency gains, and was in keeping with the longer term development of the Trans Labrador Highway" (ADI 1984).

1.5.1 Current Use of the Road System

The Esker Road is maintained and used by CFL Co. to transport supplies eastward from the Esker siding (weekly food shipment; equalling about 1500 tonnes of goods/year). The company also uses it for access to their control structures. Other users are:

- Lobstick Lodge
- Innu community at Lobstick Lake
- Proposed Whitefish harvesting operation near Lobstick dam - Michekemau Fisheries
- Approximately 120 cabins located along the road and owned principally by Churchill Falls residents. Only 6 are located between Gabbro structure and Esker
- Limited travel by Labrador West residents via the QNS & L Railway.

In 1983 and 1984, over 400 vehicles used the Esker Road. The Wabush to Ross Bay Junction Road is being used increasingly by Labrador West residents as they develop cabins in the area. There are currently around 80 cabins existing or being built adjacent to the Ashuanapi River at Ross Bay Junction.

A trailer park has been proposed at Lac Grand Hermine between Wabush and Ross Bay Junction.

The Churchill River Road (Freedom Road) has limited use due to its design and condition. Uses include:

- Limited trucking of goods (construction materials, household effects from Happy Valley/Goose Bay to Churchill Falls.)

- Limited travel by Labrador West and Churchill Falls residents to Happy Valley/Goose Bay.
- Proposals for development along the Freedom Road include a motel and gas bar at Cache River.
- About 40 recreational cabins.

2. PROJECT APPROACH (METHODOLOGY)

2.1 The Environmental Assessment (EA)

Consistent with the specifications in the EA Act (1980) and the EA Regulations (1984), the Environmental Impact Study (EIS) was preceded by a number of tasks as specified in Section 1.1.

This environmental assessment even though it was divided into a number of separate component studies, proceeded through a set of specific tasks:

- Examine existing literature and resource material
- Determine the sensitive variables within each component
- Describe the existing status of these variables, i.e., establish background conditions.
- Select a preferred alignment
- Predict the impact the undertaking will have on the existing conditions.
- Develop a mitigation and monitoring strategy as required.

The seven component studies were undertaken by five component consultants under the direction of DeLCan. Their final reports were submitted in late March 1986.

2.2 Project Scoping Workshop

Using the Terms of Reference for the EA and the component studies as guidelines, a two day scoping workshop was held in January 1985. The objective was to re-examine all the Terms of Reference and refine the study area boundaries, identify the key indicators of environmental impact and assign responsibility for the work in terms of what would be expected of each component.

System diagrams (Figure 2.2.1) were filled in for each component with the participation of the study team, the client and the Department of Environment. The set of completed system diagrams is enclosed as Appendix D.

The workshop also involved development of an information schedule which set out what information would be supplied to whom and when. This was based on the system diagram. An outline of the component report, EIS report and a sample of the reporting format was presented. Finally each component defined, "significance" as it applied to that component (see Chapter 3.0). At this stage no attempt was made to determine significance among components.

In summary, the workshop served as an integration and communication tool, setting each component in the context of the environmental assessment and establishing specific lines of communication. More importantly, it permitted the EA study participants a better appreciate the needs of other component studies and to review where and how in the EA their information would be used.

2.3 Component Study Methodologies

2.3.1 Engineering/Meteorology Study

Engineering - Engineering data were recorded for the following items:

- the road geometry (standards)
- the bridge and structure requirements
- construction planning (operations)
- construction scheduling
- labour requirements
- costing

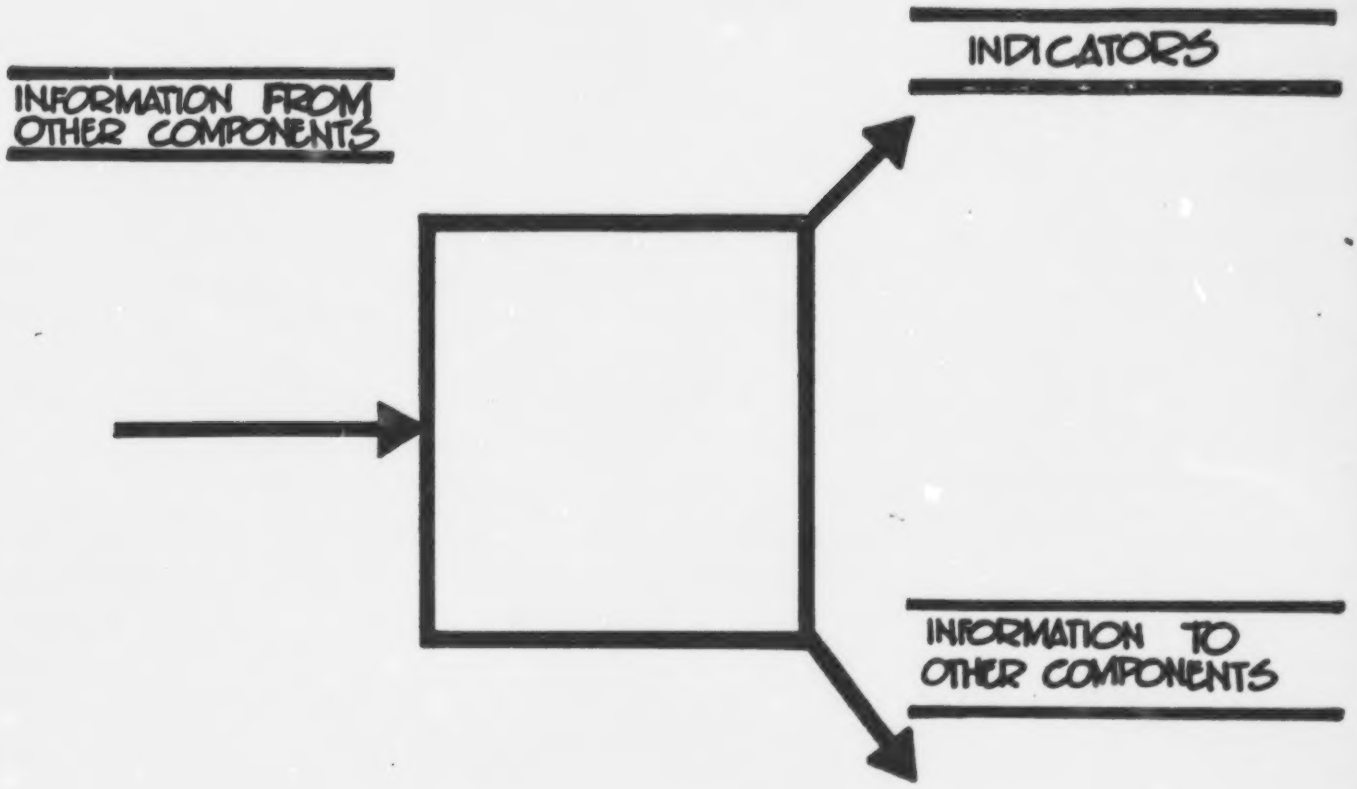

INFORMATION FROM OTHER COMPONENTS
INDICATORS
INFORMATION TO OTHER COMPONENTS

Figure 2.2.1 Example of Systems Diagram

These data were obtained from Department of Transportation files and from personal communications with the Department's Highway Design Division and from the terrain analysis performed as part of the assessment (see Section 4).

These data were also used by the other components to gauge the duration and extent of the impact the proposed undertaking would have on the natural and social environment.

Meteorology - Meteorological information for the study area was assembled from existing synoptic data charts obtained from the Federal Atmospheric Environment Service for Labrador City, Wabush and Churchill Falls. Data were summarized for up to 25 years and the statistical means, ranges and standard deviations were calculated. Data collected were:

•	Air temperature	(Environment Canada, 1981)
•	Precipitation	(Environment Canada, 1981)
	- snow/rain/fog	(Environment Canada, 1983)
•	Wind	(Environment Canada, 1982)
•	Hours of Sunshine	(Peach, 1975)
•	Visibility	(Environment Canada, 1983)

Both tabular and graphic summaries were prepared and are presented in Section 3.1.1.

2.3.2 Geology/Soil and Vegetation Study

Soil, geology and geomorphology data were obtained from past studies completed by Lopoukhine et al (1978), Fulton et al (1974) and Greene (1974).

Surficial material and mineral deposits were summarized in terms of the land forms and bedrock geology occurring in the study area. Evaluation of the terrain features along the proposed Tote Road right-of-way were completed using the Ecological Land Classification (ELC) system as discussed in the guidelines for mapping by Lacate (1969). This method is based primarily on a systematic division of the study area into ecologically significant land segments composed of a pattern of landscapes, vegetation and water bodies. The appropriate terminology used in the ELC system is:

Ecotype → Ecosystem → Ecodistrict → Ecoregion
(small) (large)

Depending on the amount of detail required, the evaluation of biotic and physical resources within these segments may be presented as a broad pattern of contiguous landscapes (ecoregions and ecodistricts), or as an individual component of this pattern with some specific characteristics (ecosystems and ecotypes).

Terrain and vegetation data were obtained from a photogrammetric analysis of a 1983 photomosaic and stereo-pairs aerial photographs of the study area. Furthermore, corroborative data on vegetation, flood levels and surficial geology were obtained from C.F.L. Co. records kept during the installation of the transmission line towers at the study area south of the proposed alignment.

2.3.3 Aquatic Study

Aquatic investigations were conducted along the proposed and alternate routes of the Labrador Tote Road from the 23rd. to the 31st. of July 1985. These studies consisted of two levels of investigation:

1. reconnaissance-level habitat mapping of watercourses within the Tote Road corridors, and

2. more detailed site-specific investigation at selected stream crossings.

These crossings, 18 on the proposed route and 6 on the alternate route, were selected by the Federal Department of Fisheries and Oceans (DFO) and the Department of Transportation during earlier reconnaissances.

The first order habitat mapping was performed visually from the air (helicopter). Stream habitat was classified into the following general categories based upon substrate type, apparent velocity, depth and available cover:

Type 1	Salmonid (trout and ouananiche) spawning and rearing habitat - gravel substrate low to moderate current velocity, relatively shallow (less than 1 m).
Type 2	Salmonid rearing habitat - cobble-boulder substrate, moderate current velocity, depth shallow (less than 1 m).
Type 3	Poor fish habitat - large boulder or bedrock substrate, high velocity with extensive "white water", depth variable.
Type 4	Adult salmonid and pike habitat - substrate frequently sand or silt, very low velocity or standing water, usually greater than 1 m deep.
Type 5	Poor fish habitat - poorly defined or obstructed stream.

Lakes were visually classified as shallow, moderate or deep whenever visibility was adequate. At each site selected for more detailed investigation, the following data were compiled in the vicinity of the proposed crossing:

1. bank vegetation,
2. bank composition and apparent stability,
3. bank height,
4. stream gradient, and
5. stream substrate composition and stability.

In order to compute stream discharge, stream depth and velocity were measured on a transect across each watercourse.

Fishing was attempted at each of the study sites selected for detailed investigation. In most cases, electrofishing was conducted with a Smith Root Type VIIIa electrofisher. Electrofishing was replaced or augmented by angling, beach seining or gillnetting at some sites. In all cases, both catch and effort were recorded. All fish captured were identified, measured and weighed; with the exception of a few gill netted and angled individuals which were released alive. Scale samples were retained from brook trout for age-growth analysis.

Impact of the project was assessed both within the individual basins affected at each river crossing and along the route's watershed as a whole. The following terms were selected from the list provided (DeLCan) at the scoping workshop and defined within the framework of the aquatic study.

Short-term impact refers to an impact, the effects of which would be limited to the actual period of construction and within one year thereafter.

Long-term impact refers to impacts that are sustained or those with residual effects lasting longer than one year after construction.

Significant impacts may be manifested in two ways:

1. depletion of a valuable fish resource, and/or
2. degradation of physical or chemical conditions within a watercourse which would adversely affect either fish production or use of the watercourse by humans or wildlife.

Minor impact is a small or short-term change in the relative abundance of an important fish species or a temporary decline in habitat quality.

Major impact is a drastic decline in the abundance of an important fish species such that it would be no longer able to support a recreational or a traditional domestic fishery. In terms of habitat, a major impact would be either a migration barrier or severe habitat degradation such that future fish production would be reduced.

Important species are those fishes valued by either recreational, domestic, or commercial fisheries. In the study area, these include brook trout (Salvelinus fontinalis), lake trout (S. namaycush), ouananiche (Salmo salar), northern pike (Esox lucius), and lake whitefish (Coregonus clupeaformis).

For details, please refer to Aquatic Studies Component Report (LGL Ltd., 1986) and Section 3.1.3 of this report.

2.3.4 Wildlife Resources Study

The wildlife study focused on the Lac St. Joseph caribou (Rangifer tarandus caribou) herd. The study area was surveyed once from the air then divided into a number of "strata", each 12 km wide, stretching the breadth of the study area from east to west. Twenty-five female caribou were radio collared and tracked for the next year. Tracking data were assessed in terms of distance and direction of travel with reference to the proposed and alternate roadway alignments. In late October 1984 an aerial age and sex classification survey was undertaken to determine size, makeup and reproductive potential of the herd.

The seasonal distribution of the herd was also estimated using the principles of the "home range method" originally developed by Dalke and Syme (1938). This survey was undertaken in spring, summer, fall, winter and late winter (March-April) of 1984-1985.

Data on other wildlife were obtained coincidentally or from information provided by other components. There was no systematic attempt to gather data on wildlife study other than caribou as this species was shown to be the significant wildlife resource in the area.

For further details refer to the Wildlife Component Report (G. St. Martin and J. Theberge, 1986) and Section 3.1.4 of this document.

The following definitions pertaining to significance were applied during the assessment of the severity of the impact on caribou.

• No Impact: (not significant)	The project will not result in either direct or indirect death of caribou.
• Moderate Impact: (moderately significant)	The project will result in caribou mortality but not enough to destabilize the population
• Major Impact: (very significant)	The project will result in caribou mortality which is higher than the recruitment (replacement) level.

2.3.5 Socio-Economic Study

In order to focus on the socio-economic issues which would reflect the conditions in this study area, three parallel approaches were used:

- A resident survey was conducted to determine what the actual and perceived socio-economic concerns are and what the general socio-economic climate is in the 7 major communities in this study, namely;

    - Labrador City
    - Wabush
    - Churchill Falls
    - Happy Valley - Goose Bay
    - Northwest River
    - Sheshatshui
    - Mud Lake

    This was accomplished by a letter and telephone interview approach.

- A literature review was completed in an effort to find any comparative information which focused on northern community socio-economic impacts and impact methodology.

- A relevancy tree procedure was completed in order to identify the relevant factors to be addressed in the study within the following three main user categories affected:
    - households
    - communities
    - organizations and groups

Once all factors were identified and categorized, two field questionnaires were developed and were administered either by a site interview or through a mail-in format. One questionnaire was designed for the business community, while the other was prepared for use by the local residents. All samples were chosen using a stratified random sampling approach.

Secondary numerical data, such as population characteristics, labour force and housing numbers were obtained from Statistics Canada (1981) records. These data were updated where possible by discussions with local community leaders.

Numerical data were, for the most part, summarized and presented as trends over time (up to 10 year) to illustrate the rate of socio-economic change taking place in Labrador.

The survey data were collected from 170 interviews distributed among the various groups and locations (Table 2.3.5.1).

Table 2.3.5.1 - Summary of the socio-economic study survey (allocations by geographic area and interest group)

Area	Businesses < 10 people	Businesses > 10 people	Resident Surveys	Total
Churchill Falls	4	3	20	27
Happy Valley/Goose Bay	20	8	N/A	28
Labrador City	12	8	N/A	20
NW River/Sheshatsui	0	2	N/A	2
Wabush	5	4	N/A	9
Labrador West (for res. survey only)	N/A	N/A	43	43
Labrador East (for res. survey only)	N/A	N/A	41	41
Total	41	25	106	170

Detailed methodology and the survey instruments are presented in the socio-economic component report (D.W. Knight & Associates, 1986).

2.3.6 Tourism/Recreation Study

The three distinct data sources dictating which methodology would be applied in this study were:

a) Opinion survey of local community residents documenting local perception of the impact of the project on tourism/recreation in the study area (in an attempt to identify relevant impact indicators).

Three types of surveys were administered:

- resident survey
- community and business leaders survey
- wilderness tour operators and outfitters

b) Quantitative data (where available) on the natural resources in the area were taken from EA component study results and also from the provincial Wildlife Division and the Canadian Wildlife Service.

c) Statistics on historical tourism/recreation use of the area was extracted from Provincial Department of Development and Tourism summaries of tourism/recreation use in the province.

Since the data were lumped for the entire province, figures for the Labrador component were estimated and approved for use by Department of Development and Tourism officials.

The literature review revealed few pertinent studies with the exception of the Yukon Territory Tourist Industry study (Alaska Highway).

These data were assembled and summarized between January and October 1985 and presented in a series of comparative data tables(Knight,1986).

Methodological details are presented in the Tourism Recreation Study Component Report (Knight 1986).

2.3.7 Native Resource Use Study

The original work program for the Native Resource Use Study called for anthropological field surveys in February 1985 among the Innu, in and around the study area. (Labrador Schefferville and the Quebec North Shore). The objective was to obtain first hand data on resource harvest. Due to the land claims considerations of the Quebec based Innu, the research team was refused permission to conduct any survey work in the Quebec communities by their three Band Councils and the Regional Status Indian Association. Interviews were carried out as planned with the Innu in Sheshatshui.

With the exception of the completion of an extensive literature review this turn of events forced a major revision of the approach to this component study.

The study area was divided into two subregions: the Ashuanipi River area along the western edge of the study area (Figure 1.2.1), and the Esker Road area between Churchill Falls and Esker. The divisions were based on traditional and separate Innu hunting areas.

Both present and future harvest numbers were based in large measure on estimates predicated on the following assumption:

- available current and historical data although directly pertaining to areas some 300 km from the study area were similar enough to permit extrapolation to this project.

Present harvest data were estimated using two sources:

- Sheshatshui Innu interviews on use
- unpublished harvest study (Tanner, 1977)

Future levels of harvest were based on a general understanding of the wildlife productivity of the area and the level of harvest, applying the Innu land use pattern of hunting and trapping. In order to arrive at a realistic harvest level, an estimate of hunting group utilization of the study area was derived by extrapolating data from the Rogers (1973) study in Mistassini during 1954-55 and by Tanner (1979) in 1969-70. This approach provided the only available quantitative method for calculating the resource harvest.

Future harvest projections were also calculated for three project related scenarios, namely:

- the proposed road link
- a year round maintained road
- a year round road connected to the national highway system

The detailed methodology is presented in the Native Resource Use Component Study (Tanner and Armitage, 1986).

2.3.8 Historic Resources Study

The methodology applied to this study involved three data collection tasks:

a) a complete review of archival data including reports, aerial photos and EA component studies (Tanner & Armitage, 1986, DeLCan, 1986)

b) a 2-day preliminary air reconnaissance of the two alternate roadway corridors to identify any obvious archeological sites

c) a 9 day field survey (on foot) along all areas identified in tasks a and b or having historical significance. Minimal subsurface "shovel" testing was also completed at all identified (potential) sites.

Significant sites were identified on a study area map so that their proximity to the proposed roadway could be shown. Further methodological details are presented in the Historic Resources Component Study (Penny, 1986).

2.3.9 Public Participation Program

The public participation program, a key requirement of the EA process involved conducting a comprehensive set of "open house" public information sessions in the communities affected by the project. The proponent (DOT and their consultants) presented information and then entertained questions and/or briefs. All exchanges were recorded and a transcript of each meeting was retained.

A. Approach

The Public Information Sessions were designed such that the general public and/or organized groups could attend at convenient locations and talk with resource persons and view displays providing factual information on the proposed project. The sessions also permitted them to immediately and informally express their interests and concerns regarding the undertaking. During the second round of information sessions, provision was made for the acceptance of formal statements of interest or concern for the record.

B. Public Notification

Each public information session was widely advertised by means of radio, newspapers, television and posters. In Sheshatshui advertisements were made in English and Innueimun. Letters were also sent to Naskapi-Montagnais Innu community leaders in Schefferville and Sept Illes, Quebec and to the President of the National Innu Council (CAM) (located in Quebec City) advising them of the information sessions and inviting them to attend. Community leaders in each of the communities where sessions were held also received advance notification of the sessions by correspondence from the Minister and Deputy Minister of Transportation. Labrador Environ. Services Ltd. (1986), in their report on the public involvement programe provided examples of advertisements and notices distributed prior to the information sessions.

C. Location and Schedules

Sessions were held in each community (Table 2.3.9.1 and Figure 1.2.1) in a central and public place that permitted the ready display of project descriptive materials.

Table 2.3.9.1 - Location and schedule of public information sessions in 1985.

Community	Date 1st Session	 2nd Session	Location
Happy Valley-Goose Bay	Feb. 25 & 26	Sept. 16	Labrador Room, District Vocational School
Mud Lake	Feb. 27	Sept. 25	Community Hall
Sheshatshui	Sept. 28	Sept. 17	Boardroom, Band Council Office Peenamen MacKenzie School
North West River	Mar. 1	Sept. 18	Recreation Centre Municipal Building Church Basement
Labrador City	Mar. 4 & 5	Sept. 23	Labrador Mall O'Brien Hall
Wabush	Mar. 6	Sept. 24	Wabush Plaza Sir Wilfred Grenfell Hotel
Churchill Falls	Mar. 7	Sept. 19	Churchill Falls Inn Churchill Falls Inn and High School
Lobstick		Sept. 20	Innu camp site

On September 25, at the request of the Labrador Joint Municipal Councils, DeLCan presented a summary of preliminary findings and conclusions in Happy Valley - Goose Bay.

D. Information Sessions

At each information session, maps of the proposed route and the alternate route were displayed alongside a set of posters explaining the various study components (specified in the Terms of Reference). The posters also provided addresses for points of contact should a member of the public want more detailed information than was available at the sessions.

An informal atmosphere was stressed throughout the sessions so as to encourage members of the public to attend and express their views. During round one, the sessions generally ran from 10 a.m. to 2 p.m. and 4 p.m. to 7 p.m. In some locations sessions were shortened due to logistical constraints. During round two, the sessions generally ran from 1 p.m. to 4 p.m. and 7 p.m. to 9 p.m. and these sessions were slightly more formal in that provision was made for the recording of formal statements of interest or concern. The evening sessions were chaired by B. Boles. Roger Pottle of the Department of Transportation made a presentation providing the answers to numerous questions raised in the first round of sessions. T. Houlihan of DeLCan provided a summary of the findings and conclusions to date of the various component studies undertaken to support the EIS. Following these presentations, a discussion took place between the audience and the proponent's resource people, on various apects of the proposed project.

Answers to questions posed during the second round of information sessions were answered either on the spot or by letter shortly after the meetings in late September 1985.

In attendance at each session were resource people from the Department of Transportation and their environmental impact assessment consultants.

Further details on the methodology, the attendance and transcript of are presented in the Public Participation Component Study (Labrador Environmental Services, 1986).

2.4 Alternatives: Evaluation Process

Planning Alternatives

Planning alternatives were examined principally in three previous studies:

- a Trans Labrador Railway Feasibility Study
  (DeLCan, 1980)
- Quebec - Trans Labrador Highway Study
  (Noah, 1974) and
- Labrador Road Needs Study
  (A.D.I. Ltd., 1984)

The preferred alternative was chosen on the basis of:

- useability by the maximum number of people
- economic useability of the system
- construction and maintenance costs
- long term cost/benefit to Labrador

The results of this evaluation are discussed in Section 4.1.

Design Alternatives

Two basic design alternatives were considered a southern or proposed alignment and a northern or alternative alignment. The preferred alignment was selected by assessing the numerical value of a set of key indicators for each component (established during the component studies). The key indicators for each component, chosen during a scoping workshop described in Section 2.2, were:

i) Aquatic Resources

- Number of water crossings affecting fish habitat
- Number of rivers crossed with exceptional salmon habitat
- Amount of sensitive fish habitat vulnerable to direct impact
- Number of potential commercial fishing sites

ii) Wildlife

- Caribou habitat significantly affected % of total
- Caribou habitat cost % of total
- Proportion of Caribou herd affected
- Probable caribou mortality related to project as % of total
- Waterfowl habitat loss (ha)

iii) Vegetation, Soils and Geology

- Merchantable timber potential
- Number of vegetation communities lost
- Number mined sites (borrow areas)
- Revegetation potential

iv) Native Resource Use

- Native resource harvest
- Number native families directly affected
- Socio-cultural degradation as function of reduced hunting

v) Socio-Economics

- Number of jobs
- Average travel time Lab-City-Churchill Falls
- Trucking costs ($/ton) Lab-City-Churchill Falls
- Extent of new business opportunities

- Proximity of road to user
- Likelihood of loss of access, i.e. barrier effect

vi) Tourism-Recreation

- Number of tourists (user-days)
- Number of new cabins per year
- Change in tourism-recreation opportunity
- Change in user share of resource: native, versus non native

vii) Engineering

- Construction costs
- Maintenance costs
- Future use (traffic volumes)

viii) Historic Resources

- Number of sites disturbed
- Number of likely significant sites to be discovered or destroyed along the alignments.

Senior component specialists were then asked to weigh the eight components in terms of their relative importance. Furthermore they were asked to weigh the key factors within their specific component and attach numerical values for each indicator for the two alignment alternatives. As these results all had varying units of measure, the data were examined "as is", i.e. no further coding or collapsing of numbers was performed. Since many of the important indicators were already scalar values further coding would only have obscured the quantitative results. Further discussions of the results of the selection of a preferred design is provided in Section 4.2 of this report.

2.5 Department of Transportation (DOT) Participation

Being the proponent, the DOT was closely involved in the EIS throughout the work period.

- The Study Director was Mr. Roger Pottle, Environmental Planner for the Highway Planning and Research Division of DOT. Other DOT staff closely involved in the study were:
  - Mr. T. Beckett, Director, Highway Planning & Research Division
  - Mr. T. McCarthy, Director, Highway Design Division
  - Mr. D. Matthews, District Engineer, Labrador

2.6 External Participation

The consultant established an external review panel who examined the component terms of reference and the draft final component reports. This peer review was one part of the comprehensive quality control program set in place for this EIS.

The members of this review panel were:

D. House, Ph.D.	Sociologist
G. Pope, Ph.D.	Fisheries Biologist
J. Tuck, Ph.D.	Archaeologist
T. Northcott, M.Sc.	Terrestrial Biologist

Furthermore, an Environmental Assessment Committee was designated by the Department of Environment. Their function was to evaluate all information coming from the EIA and decide on its adequacy. The members of that committee were:

Chairman

Mr. Michael Rigby
Director, (Acting), Environmental Assessment Div.
Department of Environment
St. John's
Members

Mr. Hugh Bain
Inland Fisheries & Habitat Mngmt.
Fisheries & Marine Service
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During the course of the study, DeLCan made one presentation (April 1985) to the EA Committee concerning study progress to date.

3. EXISTING CONDITIONS

In this section of the EIS, we present a description of the existing conditions with respect to both the natural and socio-economic environment of the study area. It will be against these baseline data that the predicted changes (and monitored actual changes) will be compared to determine the level and severity of the impact.

3.1 Natural Environmental Setting

The study area is for the most part wilderness with little visible disruption of the natural ecosystem since prehistoric times. Labrador City on the western periphery and Churchill Falls on the N.E. boundary of the study area are the only major population centres directly affected by the project.

There have been four major man-made modifications to the natural environment in the study area (Figure 3.1.1). Most significant is the Churchill Falls Hydroelectric Development reservoir which extends from south to north across the centre of the study area. The other three major changes have been:

- the North Shore and Labrador rail line from Sept Isles to Schefferville with a branch line from Ross Bay Junction to Wabush
- the CFL Co. road from Esker to Churchill Falls
- the transmission lines from Labrador City to Churchill Falls parallel to and south of the proposed road route, and from the Quebec North hore to Churchill Falls.

Although it is a wilderness area, man-made influences are evident along these corridors. Wildlife resources have for example been harvested since prehistoric times (Tanner, 1986; Penny, 1986).

The following summaries are based on much more detailed component studies (DeLCan Ltd., 1986; LGL Ltd., 1986; St. Martin and Theberge, 1986) submitted as separate volumes of this EA.

3.1.1 Meteorology and Climate

The significance of climate relative to the EIS is not obvious in that there is no impact per se. Rather, it is weather patterns that would effect the type of construction and the probable maintenance program which would be needed to keep the road in usable condition.

Within the study area, climate data are recorded only in Wabush and Churchill Falls. These data were summarized over the 30 year period between 1950 and 1980.

Temperature

As both Wabush and Churchill Falls are located on the interior plateau region of Labrador, they experience very similar climatic conditions (Figure 3.1.1.1). The average annual daily maximum and minimum temperatures for Wabush and Churchill Falls are 1.3°C and -8.9°C and 1.7°C and -7.9°C respectively. The average yearly daily temperature for Wabush is -3.8°C, -3.1°C for Churchill Falls. The average annual extreme temperatures for both locations varies from a maximum of 31.1°C in July to a minimum of -47.8°C in February for Wabush and -45.6°C in February for Churchill Falls. The frost free period for both locations extends from June to September (Environment Canada, 1981).

Precipitation

Overall, Labrador experiences less precipitation than the island portion of the province. For both Wabush and Churchill Falls, rainfall and snowfall each account for approximately 50% of the total precipitation figure (Figure 3.1.1.2 and 3.1.1.3). Average total precipitation for Wabush is 938 mm of which 470 mm is rainfall and 468 mm snowfall. Average total precipitation for Churchill Falls is 971 mm i.e., 490 mm rainfall and 481 mm snowfall. The month of greatest total precipitation for Wabush and Churchill Falls is July with 105.8 mm and 119.9 mm respectively. The month of least total precipitation for Wabush is February with 48.2 mm and for Churchill Falls is May with 57 mm.

For the period 1951 - 1980, Wabush had an annual average of 201 days of precipitation; 92 as rain and 122 as snow. Similarly, Churchill Falls had an annual average of 211 days precipitation; 96 rain and 119 snow. (Environment Canada, 1981).

Wind

The prevailing wind direction for Wabush is westerly for January, February and July to December, and northerly from March to June, while for Churchill Falls, it is west northwest for all months except April and May when it is from the northwest. (Environment Canada, 1982). The average wind speeds for Wabush and Churchill Falls derived from Canadian Climate Normals (1982) are presented in Table 3.1.1.1.

Table 3.1.1.1 - Average wind speed, % calm and maximum gust derived from Environment Canada 1982 Canadian Climate Normals

Location	Average Wind Speed km/hr	% Calm	Maximum Gust km/hr
Wabush	14	17	113 WNW
Churchill Falls	16	8	103 NW

Mean monthly wind speeds for Wabush and Churchill Falls derived from Canadian Climate Normals 1982 for the period 1951 - 80 are presented in Figures 3.1.1.4 and 3.1.1.5.

Freeze-up and Break-up

Data concerning the freeze-up and break-up data for lakes and rivers in the study area were taken from Peach (1975) and based on a 1-5 year record (Table 3.1.1.2) and is presented as "first permanent ice" and "complete freeze over". Break-up data are presented in terms of "first deterioration" and "completely ice free" conditions. First permanent ice refers to when float planes can no longer land and complete freeze over refers to when planes can land on frozen water bodies with skis. The reverse applies to first deterioration and completely ice free.

Table 3.1.1.2 - Mean periods of freeze-up and break-up of lakes, bay and rivers - Labrador (Peach, 1975)

Location	First Permanent Ice	Complete Freeze Over	First Deterioration	Completely Ice Free
Churchill Falls	October	October	May	June
Wabush (Lake)	October	October	May	June

Sunshine

Information from Environment Canada concerning sunshine for the interior plateau region of Labrador is only available for Churchill Falls for the period 1968-73. The month of least sunshine is November with it occurring during approximately 17% of the daylight hours. February has 47% sunshine.

Visibility

The occurrences of reduced visibility due to snow, fog or rain for Wabush and Churchill Falls are minor. The months of greatest average visibility for Wabush and Churchill Falls are July and August which average 1 and 3 hours of reduced visibility respectively. Conversely, the month of greatest reduced visibility for Wabush and Churchill Falls is December which average 16 and 24 hours per month respectively (Table 3.1.1.3).

Table 3.1.1.3 - Mean number of 1 hour observations with visibility less than 1 km. (Peach, 1975)

Location	J	F	M	A	M	J	J	A	S	O	N	D
Wabush	14	12	12	7	6	3	1	4	3	11	15	16
Churchill Falls	18	18	14	10	8	8	5	3	5	14	15	24

Reduced visibility due to fog is present in Table 3.1.1.4 below.

Table 3.1.1.4 - Mean number of days with visibility 10 km or less due to fog. (Peach, 1975).

Location	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Wabush	1	1	0	1	3	1	0	1	4	1	0	1	14
Churchill Falls	1	1	0	1	2	2	2	1	4	2	1	1	18

Recreation

A key factor affecting participation in outdoor recreation is the weather. The degree of significance, however, is regulated by the type of outdoor activity. A "suitable recreation day" is one in which there are at least five hourly reports (not necessarily consecutive) of "suitable weather" between 10:00 a.m. and 6:00 p.m. (Crowe, McKay & Baker, 1973).

In general, most recreational activities can be classified as either winter (from November to April) or summer (June to August).

Table 3.1.1.5 - Climatic criteria for designation of a suitable day by activity or activity grouping (Peach, 1975

	Climatic Criteria for Designation of Suitable Days						
Activity	**Humidex**	**Temperature Degrees C**	**Visibility km**	**Cloud Amt.**	**Wind km/h**	**Snow Cover**	**Precipitation**
Year-Round							
Landscape Touring	-12 to 89	-24 to 24°C	greater than 5 km	N/A	less than 40 km/h	N/A	Nil
Winter							
Skiing	greater than 6	greater than -14°C	greater than 1 km	N/A	less than 24 km/h 15 mi/h	5 cm, or more	Nil or light snow or flurries
Snowmobiling	greater than -6	greater than -21°C	greater than 1 km	N/A	less than 24 km/h	5 cm, 2 in. or more	Nil or light snow or flurries
Summer							
Vigorous Activity	55 to 89 inclusive	12 to 24°C inclusive	greater than 3 km	less than 8/10	less than 32 km/h	N/A	Nil
Beaching Activity	greater than 64	greater than 16°C	greater than 1 1/2 km	less than 8/10	less than 24 km/h	N/A	
Yachting		-24 to 24°C	greater than 8 km	N/A	less than 40 km/h	N/A	Nil or light rain

N/A - Does not apply significantly.

3.1.2 Geology, Soil and Vegetation

Geology

In Western Labrador, folded Precambrian sediments form a system of valleys and ridges (Lopoukhine et al, 1978). Within the study area, bedrock is of the Churchill (sedimentary, metamorphic and intrusive) and Grenville (quartzofeldspathic gneisses) Provinces (Greene, 1974). The bedrock types underlying the proposed and alternate routes are shown in Figure 3.1.2.1 appendix.

Surficial Geology & Soils

The study area is characterized by deep till and glaciofluvial deposits. Eskers and drumlin ridges are common, while organic terrain and bedrock outcrops do not occur often.

The surficial material along the routes falls within 5 categories:

- Morainal deposits
- Glaciofluvial deposits
- Colluvial deposits
- Organics
- Rock

In Table 3.1.2.2.1, we have summarized the extent of the occurrence of the units within the routes.

a) Morainal Deposits - Mainly "till" or unsorted/poorly sorted to unstratified/partially stratified material (from clay to boulder size) that originated from direct deposition by ice without intervening water transport.

Table 3.1.2.2.1 - The occurrence of surficial material along the proposed and alternate routes.

	Proposed Route			Alternate Route		
Landform	No. of Ecosystems Containing Landform		Stability	No. of Ecosystems Containing Landform		Stability
Moraine						
- veneer	17	(37%)	Good	4	(17%)	Good
- hummocky	16	(35%)	Good	7	(30%)	Good
- drumlinoid	1	(2%)	Good	2	(9%)	Good
Moraine Totals	34	(74%)		13	(57%)	
Glaciofluvial						
- ridged	2	(4%)	Good	1	(4%)	Good
- eroded	1	(2%)	Good	5	(22%)	Good
Glaciofluvial Totals	3	(7%)		6	(26%)	
Colluvial - Complex	6	(13%)	Poor	1	(4%)	Poor
Organics	1	(2%)	Poor	0		
Rock	2	(4%)	High	2	(9%)	High

b) Glaciofluvial Deposits - Composed primarily of well- or poorly-sorted, and well- or poorly-stratified gravel and sand. This material is considered to have been deposited by glacial meltwater in proximity to ice.

c) Colluvial Deposits - Loose material of various sizes, stratification and origin, which has accumulated on and at the foot of slopes by various processes of mass movement. This landform, usually a mixture of several morphological elements, is generally unstable when disturbed.

d) Organics - Peat, muck and other material of organic origin (generally unstratified) which commonly accumulate in closed basins or around gentle slopes. Organics within the proposed and alternate route corridors are primarily classified as "string bogs." These organics vary in depth between 1-3 m. Depths of up to 5 m may be found in isolated pockets throughout major deposits.

e) Rock - Bare or moss-covered bedrock, or areas with a till mantle of up to 10 cm thick. Areas where near-surface rock severely restricts tree growth are included in this "rock" category.

The more stable landforms (moraine and glaciofluvial) are found in approximately 80% of the ecosystems within both the proposed and alternate route corridors. However, finer materials particularly sensitive to surface erosion (e.g., silts, sand, etc.) may occur in both moraine and glaciofluvial deposits. Soils mapping is shown on Figure 3.1.2.2 Appendix.

Vegetation

Vegetation was evaluated at the forest cover type level by aerial photography (at a scale of 1:50,000) permitting a species height class and a density class breakdown.

There are 27 productive forest stands (producing at least 45 m^3 per ha) along the proposed road corridor (Section 3.6.2.7). These stands, occupying a total area of approximately 10,612 ha, are composed of balsam fir and black spruce, with occasional occurrences of trembling aspen, white birch and balsam poplar. Ground vegetation under these forest stands usually consists of a continuous moss cover (e.g., Hylocomium and Pleurozium) with such shrubs as sheep laurel (Kalmia angustifolia) and labrador tea (Ledum groenlandicum) occasionally present.

Elsewhere along the corridor of the proposed route, the land mass is covered by scrub forests and organics. Scrub forests (which include lichen woodland) are vegetation types which produce less than 45 m^3 of wood fibre per hectare. Black spruce is the principal tree species in this lichen-woodland.

Scrub forest types and organics are present along the alternate route corridor. As in the case of the proposed route, these types occupy the more nutrient-poor locations.

Based on the review of existing information, the study area does not contain any rare or unique vegetation communities. The subarctic forests, of which the study area is a part, stretch in a broad band across central Labrador and much of north-central Quebec. While there are regional variations in vegetation communities over the vast distance, no region or area is substantially different from any other.

Mineral Resources

The Ross Bay Junction-Churchill Falls Esker triangle, including the proposed and alternate route corridors, is considered to have a low potential for mineral occurrences (Newfoundland and Labrador Mineral Development Division, pers. comm.). The bedrock of the area is of the Churchill and Grenville Provinces of the Canadian Shield (Greene, 1974), and is thus less productive than the rocks of much of the Labrador trough. However, geological reconnaissance in the study area has been limited because of lack of easy access, and further exploration may discover some mineral occurrences of interest.

There are approximately 15 mining leases in the area. These leases held by the Labrador mining and Exploration Co. Ltd. (LMECL), a Montreal-based company will expire within 10 years.

None of the LMECL leases occur within the proposed route corridor, but one is within 5 km of the corridor and several others within 15-20 km. The proposed route does cross a narrow section of the land to which the Churchill Falls (Labrador) Corporation Ltd. (CFLCo.) has been granted mineral rights. In the mid-1960's, CFLCo. was given a 99-year lease to the mineral rights on the lands that would be flooded by the Churchill Falls hydroelectric development. The section which will be crossed by the proposed route lies in the vicinity of Ossokmanun Lake. Most of the CFLCo. mineral lease is now covered by water.

The alternate route encroaches on the western portion of LMECL lease block B.112, (Figure 3.1.2.4.1 Appendix). This lease is 1,812.5 ha (4,479 acres) in size. Three other leases lie within 5 km east of the alternate route corridor. A survey description of lease B.112 is on file with the Mineral Lands and Mining Branch of the Department of Mines and Energy in St. John's.

3.1.3 Biophysical Classification

The study area falls within three ecoregions as described by Lopoukhine et al. (1978) in Ecological Land Classification Series No. 4 (Figure 3.1.3.1 Appendix). A brief verbatim description of each ecoregion is as follows:

Ecoregion M - Smallwood Reservoir

The Smallwood Reservoir ecoregion, the largest in Labrador, is centered on the Smallwood Reservoir and extends south to include Atikonak Lake. A private road joining Esker (on the Quebec North Shore and Labrador Railway) and Churchill Falls (in Region S) traverses this Region. This region is characterized by esker and drumlin ridges as well as organic terrain, string bogs and fens, which are prominent in the south and central portions. The creation of Smallwood Reservoir innundated numerous small lakes and expanses of organic terrain.

Vegetation:

This part of Labrador is classified as subarctic forest (Rowe, 1972). This section (B13a), of the Boreal Forest Region is between the productive forests to the south and the forest-tundra vegetation to the north. It is dominated by open lichen-woodlands with black spruce as the principal tree species. Bogs are numerous. On well drained sites closed canopy forest stands of black spruce mixed with balsam fir and white spruce occur.

Ecoregion S - Churchill Falls

Churchill Falls ecoregion extends east from the settlement of Churchill Falls to the headwaters of the Kenamu River and south to the Labrador/Quebec boundary (Figure 3.1.3.1 Appendix).

Scattered permafrost occurs in the region. Lakes are ice free for 150 to 180 days per average year and the mean annual length of the growing season is 120 days.

Physiography:

Broad river valleys, rolling topography and a preponderance of drumlinized till are characteristic of this region. Valleys are dominated by glaciofluvial material, recent alluvium and organic terrain. Upper slopes are covered with a veneer of till. Bedrock outcrops are most common near and at the top of the numerous hills. Impeded drainage has resulted in the development of organic terrain.

Vegetation:

The Boreal Forest Region (Section B-13a), encompasses the Churchill Falls ecoregion (Rowe, 1972). Lichen-black spruce woodlands are typical. Stream courses and the shores of lakes are lined by eastern larch whereas mesic sites are covered with closed canopy stands of white spruce and balsam fir in combination with the ubiquitous black spruce. Hilltops are commonly without tree cover. Numerous large burned areas attest to the frequency and intensity of fires.

Ecoregion Q - Seahorse

Ecoregion Q occupies the southwestern corner of Labrador. Labrador City, Wabush and part of the right-of-way of the Quebec North Shore and Labrador Railroad lie within this region. Drainage is to the north through the large Joseph, Shabogamo and Ashuanipi Lakes (Figure 3.1.3.1 Appendix).

Physiography:

Relatively level land interspersed with rolling terrain characterizes this region. The level areas are covered with large expanses of organic terrain while the rolling hills are composed of a mixture of veneer tills, glaciofluvial material and drumlins overlying bedrock.

Vegetation:

Ecoregion Q is within the Boreal Forest Region (Rowe, 1972). Black spruce is the dominant species. Larch is usually a minor component existing mainly on the margins of forest stands.

Wilton (1964) categorized the forest vegetation as submarginal and arctic tundra. Although Rowe's classification considers this area is productive, examples of good-growth stands are rare. "Altitude, poor soils and perennial fires have hindered commercial forest development" (Rowe, 1972).

Ecodistricts

The proposed alignment passes through 5 ecodistricts (Figure 3.1.3.1 Appendix) while the alternate alignment traverses the same 4 ecodistricts as the proposed plus ecodistrict M-11 (Table 3.1.3.1).

Ecosystems

Ecosystems are subdivisions of ecodistricts and are identified on the basis of land form pattern, soils and vegetation. An ecosystem may be relatively homogeneous in which case, it is classified as simple, whereas one with several obvious differing land forms is referred to as a compound ecosystem.

The proposed route traversed 46 ecosystems (Figure 3.1.3.1 Appendix). The roadway corridor for the proposed route comprises about 62,271 ha of land and water. The dominant ecosystems in terms of land mass are ecosystem 1 and 17 which are 9,600 ha of rolling and hummocky morains with medium to fine grained well drained soils and ecosystems 3, 7, 10, 19, 29, 34, 42 and 44. These latter ecosystems make up about 8,900 ha of land and 3,700 ha of water and are characterized by undulating hummocky topography. The soils are well drained with tree cover on slopes and string bogs and fens in the depressions.

The alternate route traverses 22 ecosystems (Figure 3.1.3.2 Appendix). The dominant ecosystems are 17, 19 and 21 with a total land mass of 15,028 ha and a water area of 2,108 ha or about 41% of the total land area within the alternate corridor.

For detailed descriptions, please refer to Northlands Associates Ltd. (1986) Biophysical Survey Report found in the appendix volume for this report. The ecosystems identified do not appear to be unusual or sensitive and in fact are very common for central Labrador.

Table 3.1.3.1 - Summary of ecodistricts crossed by the proposed (A) and alternate (B) Tote Road alignments. Based on research conducted by Northland Assoc. for DeLCan, 1986.

Ecodistrict	Location	Topography	Genetic Material	Cover Veg.	% Open Water	Comment
Q-4 (A)	km 68 and 71	level	organics/morains	moss, trees lichens	31-41	drumlinized area
(B)	km 68 and 81					
M-3 (A)	kmn 71-85 90-100	corrugated fluted	glaciofluvial & exposed bedrock	medium cover	11-20%	-
(B)	km 72-74; 121-124.5					
M-2 (A)	km 85-90 100-130	level with eroded channel	glaciofluvial	medium	11-20%	-
(B)	km 81-121; 124.5-139					
M-4 (A)	km 156-184	level	organics and drumlinized moraines	dense mosses, lichens sedges, trees shrubs	21-30	-
(B)	km 150-155					
M-6 (A)	km 184-189 195-199	level	50% organics 50% glacio-fluvials	medium desnity	21-30	-
S-1 (A)	km 189.5, 199.5	corrugated fluted	moraines & glaciofluvials	dense trees	11-20	drumlinized
M-11 (B)	km 139-150.5	corrugated	glaciofluvial	medium trees, mosses & lichens	21-30	organics & moraines

3.1.4 Aquatic Resources

Based on an aerial reconnaisance and site selection by DOT and Federal Department of Fisheries and Oceans, 18 stream crossings along the proposed route and 6 stream crossing sites along the alternate route were designated survey sites. (Detailed report has been prepared by LGL Ltd., 1986).

Fish Resources:

Of the eight fish species sampled during the July 1985 field survey, only brook trout (Salvilinus fontinalis) and pike (Esox lucius) are potentially valuable to recreational fisheries. An examination of brook trout growth revealed that along both the proposed and alternate route they are the slow growing variety as described by Wheeler (1977). It is the fast growing variety that is prized by the recreational fisheries.

Fish Habitat:

Most of the proposed stream crossings for both alignments are located in either Type 2 salmonid rearing habitat, highflow areas (Type 3) a poor fish habitat or adult salmon and pike habitat (Type 4) (LGL, 1986). Relatively, little sensitive spawning habitat was found at crossings on either route, however, the following sites were identified as being sensitive to any proposed construction activity for a variety of other reasons (Table 3.1.4.1 & 2):

- The Proposed Route:
    - km 70.5 - unnamed stream
    - km 77.5 - unnamed river - presently passable rapids at centerline; construction may create migration barrier.
    - km 82.5 - unnamed stream
    - km 85.5, Miron River - steep gradient and high discharge may already present a partial obstruction; any constriction of channel would form a complete obstruction.

- km 114.0 - unnamed river - steep gradient may cause migration obstruction in a culvert.
- km 116.5, unnamed river - good trout habitat.
- km 126.5 - unnamed stream
- km 138.0, unnamed river - steep gradient may create velocity barriers in culverts at present road location.
- km 144.0, unnamed river - steep gradient may cause velocity barriers at present road location.
- km 160.5 and 162.0, Ossokmanuan Reservoir - this site will likely be the most important sport fishing area along the preferred route. Construction of a causeway across the reservoir will create currents which will in turn attract fish.
- km 186.0, unnamed river - large river and steep gradient will likely cause a velocity barrier if channel constructed.
- km 194.5, Valley River - two channels separated by island; both have high discharges and steep gradients which could create velocity barriers in crossing structures.

Alternate Route:

Specific crossings which are most likely to result in impact on aquatic resources along the alternate route are as follows:

- km 86.5, Miron River - important fish habitat upstream; proposed bridge should minimize impact.
- km 103.5, Bernadette River - abundant brook trout and good rearing habitat.
- km 121.5 - Evening river
- km 147.5, unnamed river - excellent salmonid rearing and spawning habitat. An esker adjacent to the shoreline has been identified as a borrow site the use of which could result in chronic siltation of this watercourse.

Resource Utilization

At present, relatively little angling occurs along the proposed route. During the field program, anglers were observed fishing on a small unnamed lake near km 71.5 which is presently accessible from Wabush by an existing road to a communications tower. In addition, some local residents have transported light aluminim boats beyond the end of the existing road (km 70.0), most probably to fish Embro Lake and some adjacent small ponds, all of which are situated near the proposed road. No angling activity was observed along the alternate route during the field program but several sites are presently accessible via the QNS and L Railroad. A minimal amount of commercial fishing takes place on the Ossokmanuan Reservoir with an estimated total landing of less than 2,000 kg per year (T.R. Porter, DFO in LGL Ltd., 1986).

Key Indicators

Key indicators in terms of impact on the aquatic environment of the two alternatives were:

- No. of water crossings over fish habitat
- No. rivers crossed with exceptional salmonid habitat
- M^2 of fish habitat vulnerable to direct impact by proposal
- No. of rivers crossed with significant fish migration
- No. sites on routes crossed with commercial fishing potential (positive impact)

Tables 3.1.4.1 and 3.1.4.2 provide a summary of the physical condition of each stream crossing.

Table 3.1.4.1 A summary of the biological and physical data measured at selected stream crossings along the route of the Labrador tote road in July 1985. * = sensitive crossing (from LGL Ltd. 1986)

Km	70.5*	72.0	77.5*	82.5*	85.5	88.5
Watercourse	unnamed	unnamed	unnamed	unnamed	Miron R.	unnamed
Maximum depth (cm)	56	51	26	>100	-	69
Mean depth (cm)	34.5	24.7	16.4	66	100	38.7
Max velocity (m/s)	.45	.23	.88	.22	-	.5
Mean velocity(m/s)	.025	.108	.56	.161	1.7	.287
Width (m)	9	3	16	15	10	12
Discharge (m /s)	.078	.08	.5	1.59	17	1.33
Gradient (%)	.1	.4	.5	.1	.9	.3
Substrate type	boulder	cobble	boulder	boulder	bedrock	boulder
Apparent stability	stable	stable	stable	stable	fair	stable
Bank height (m)	<1	<1	<1	<1	3-4	<1
Bank slope	gentle	gentle	gentle	gentle	steep	gentle
Bank composition	organic	organic	organic	organic	bedrock	organic
Bank vegetation	shrubs	spruce	spruce	spruce	spruce	shrubs
Riparian cover	nil	extensive	little	fair	little	minimal
Habitat type	type 2&4	type 2&4	type2	type2	type3	type2
Salmonid abundance	abundant	rare	rare	common	present	rare
Sensitive areas	spawning downstream	none noted	none noted	spawning area	rearing downstream	none noted

Table 3.1.4.1
Continued

Km Watercourse	138 unnamed	144 unnamed	157 unnamed	179 unnamed	186 unnamed	194.5 Valley R.
Maximum depth (cm)	-	86	40	98	150	38
Mean depth (cm)	100	42.8	27.6	55.4	40	21.5
Max velocity (m/s)	-	.93	.95	.25	-	.84
Mean velocity(m/s)	2.5	.56	.686	.24	1.1	.45
Width (m)	15	11	14	4.5	20	15
Discharge (m /s)	35	2.7	2.82	.59	8.8	1.21
Gradient (%)	3.5	-	.3	.1	2.6	1.8
Substrate type	boulder	boulder	boulder	cobble	boulder	boulder
Apparent stability	stable	stable	stable	stable	stable	stable
Bank height (m)	1	2	1	<1	3-5	5
Bank slope	gentle	45	gentle	gentle	moderate	moderate
Bank composition	bedrock	morraine	fluvial	organic	morraine	gravel
Bank vegetation	spruce	spruce	spruce	low shrubs	alder	alder
Riparian cover	extensive	extensive	minimal	nil	fair	minimal
Habitat type	type 3	type 2	type 4	type 4	type 3	type 3&4
Salmonid abundance	common	common	rare	nil	-	present
Sensitive areas	high velocity	none noted	none noted	none noted	none noted	none noted

Table 3.1.4.1.
Continued

Km Watercourse	103 unnamed	111.5 unnamed	114 unnamed	116.5 unnamed	122 unnamed	126.5 unnamed
Maximum depth (cm)	34	35	58	57	76	53
Mean depth (cm)	21.2	26.5	42.3	28.9	54.4	34.1
Max velocity (m/s)	.68	.34	–	–	.39	.93
Mean velocity(m/s)	.412	.125	1.4	1.9	.206	.49
Width (m)	4.5	5	12	12	15	15
Discharge (m /s)	.39	.13	7.1	6.6	1.68	2.5
Gradient (%)	.6	.1	.8	.8	.2	–
Substrate type	boulder	boulder	boulder	boulder	boulder	boulder
Apparent stability	stable	stable	stable	–	stable	stable
Bank height (m)	<1	5	<1	10	<1	<1
Bank slope	gentle	gentle	gentle	40	gentle	gentle
Bank composition	rock	–	organic	morraine	organic	organic
Bank vegetation	spruce	alder	shrubs	alder	spruce	alder
Riparian cover	extensive	extensive	little	extensive	extensive	good
Habitat type	type 2&3	type 5	type 2&3	type 2	type 2	type 2
Salmonid abundance	rare	present	present	common	present	present
Sensitive areas	none noted	none noted	none noted	none noted	none noted	spawning area

Table 3.1.4.2 A summary of the physical and biological characteristics measured at selected sites along the alternate route of the Labrador Tote Road in July 1985. * = sensitive crossing (from LGL, 1986)

Km.	86.5*	103.5*	121.5*	125	130	147.5*
Watercourse	Miron R.	Bernadette R	Evening R.	unnamed	Wide R.	unnamed
Maximum depth (cm)	100	78	36	100	92	55
Mean depth (cm)	60	39.9	12	-	55.4	36.2
Max velocity (m/s)	-	.94	.69	none	.24	.84
Mean velocity(m/s)	1.3	.496	.34	-	.155	.459
Width (m)	60	16	27	20	9	26
Discharge (m /s)	45	3.6	1.1	.1	.8	4.3
Gradient (%)	2	.4	.5	.1	<.1	1
Substrate type	boulder	boulder	cobble	organic	boulder	gravel
Apparent stability	fair	stable	stable	poor	stable	fair
Bank height (m)	10	<1	<1	<1	2-3	2
Bank slope	60	gentle	gentle	flat	gentle	moderate
Bank composition	gravel	morraine	organic	bog	organic	gravel
Bank vegetation	spruce	alder	spruce	grass	shrubs	alder
Riparian cover	nil	nil	nil	nil	nil	nil
Habitat type	type 3	type 2	type 2	type 4	type 4	type 1&2
Salmonid abundance	common	abundant	abundant	common	rare	present
Sensitive areas	none	none noted	spawning gravel	none noted	none noted	spawning habitat

3.1.5 Wildlife Resources

Caribou

The most significant wildlife resource in the study area is the caribou and specifically the Lac Joseph Herd. The present (1985) herd has a minimum size of about 223 animals down from 3,050 (Folinsbee, 1975) ten years ago. Over-hunting, natural and predation mortality and habitat flooding have been sited by many authors (Folinsbee, 1976; Pilgrim, 1979, Wetmore, 1971) as the cause of the population decline. Since 1975, the herd has, for the most part, been wintering in the headwater region of the Magpie River and just west of there, some 60-70 km from the proposed alignment.

Numerous (379) unused caribou trails generally oriented NW-SW or N-S were noted on the aerial photographs between km 70 and 140 of the proposed route. These trails, crossing the proposed alignment, suggested that at one time there was active caribou movement across the alignment of the proposed roadway. The average rate of travel based on the radio tracking records was 0.833 km/day and averaged about 19.5 km in total per animal. It was unclear from the radio tracking study if the herd moved in a specified pattern or simply dispersed according to where the habitat and food was located.

Assessment of the population's regenerative capacity showed a slightly below normal sex ratio of 1.3 females to 1 male animal. The following life history statistics were also estimated:

	Annual Percentages
Female pregnancy rate	92%
Natural mortality females	16%
Natural mortality (calf birth to 5 months)	42%
Hunting (presently restricted)	unknown

Caribou Habitat

Based on the tracking study, the Lac Joseph herd does not migrate. Being such a small herd, most probably, it does not need to move far to find good caribou habitat which is common in the area. Based on our (St. Martin & Theberge, 1986) investigation, the roadway corridors do not cross or eliminate any exceptional feeding, resting or calving areas and would not eliminate enough habitat to significantly affect this herd. As the range of the herd probably extends throughout the study area, the proposed alignment passes through the "core" range of the herd. The core range is described as the Lac Joseph-Atikonak-Panchia Lake area (St. Martin and Theberge, 1986).

The George River herd, the largest caribou herd in the world (760,000 animals) has been extending its range southward as it grows at an uncontrolled rate of 15% per year. In all likelihood, during the construction period (5-8 years), outlayers of the herd might invade the Lac Joseph range along the northern boundary of the study area.

Resource Utilization

Moose and Caribou:

Moose (Alces alces) hunting is legal in only a very small portion of the study area (St. Martin and Theberge, 1986). During the 1984-85 hunting season, 5 moose were harvested.

Caribou hunting is illegal in the vicinity of the proposed roadways and in most of the study area save for the extreme NW corner.

Furbearers:

The total value of furbearer harvest in 1983-84 was $64,675.50.

The marten (Martes americana) is the most important species harvested by local trappers in the study area; 436 animals were harvested during the 1983-1984 trapping season (see Table 3.1.5.1) . Red fox (Vulpes vulpes) was the second most important furbearer harvested.

About 20 black bear were reported killed during 1983 and 1984.

Wolves (Canis lupus) are common throughout Labrador although at present, at a low density, i.e., about 1 wolf per 60 km^2 (Pilgrim, 1978). During this study, 4 wolves were observed. Assuming such a low density, the 37,500 km^2 study area theoretically supports about 625 wolves.

Table 3.1.5.1 - Fur harvest during the 1983-1984 trapping season (01 July, 1983 to June 1984) in the study area. (Compiled by F. Philips Provincial Wildlife Division).

Species	Churchill Falls (No.)	Wabush Lab City (No.)	Mean Value ($)	Total Value ($)
Beaver	7	8	20.00	300.00
Marten	436	207	70.00	45,010.00
Mink	28	25	15.00	795.00
White Fox	1	-	25.00	25.00
Wolf	5	-	175.00	875.00
Weasel	46	14	2.00	120.00
Red Squirrel	28	2	.25	7.50
Otter	8	12	75.00	1,500.00
Muskrat	4	117	3.00	363.00
Lynx	1	-	400.00	400.00
Cross Fox	20	5	100.00	2,500.00
Red Fox	190	56	50.00	12,300.00
Silver Fox	10	2	40.00	480.00
			TOTAL VALUE	$ 64,675.50

Waterfowl

Of the 19 species harvested in the study area, the most heavily utilized is the Canada goose (Branta canadensis) making up about 20% of the total kill. The goldeneye (Bucephala clangula) and black ducks (Anas rubripes) are the other two intensively harvested ducks.

Although no specific data have been assembled, based on a knowledge of the area (personal communication Boles, 1986; CWS, 1986), the proposed alignment in the vicinity of the Ossokmanuan lake could significantly accelerate the Canada goose kill since this prime goose habitat would now be accessible by road.

Upland Game Birds

The estimated harvest of ptarmigan in Interior Labrador (including Churchill Falls, Wabush and Labrador City) in 1983 was 20,543 ± 10,395 (Anon, 1984); the proportion of this total from the study area is unknown.

Other Wildlife

Numerous other small mammals, small reptiles, song birds, raptors and predatory bird populations are found in the study area (St. Martin & Theberge, 1986), but would not be measurably affected by a tote road provided that environmentally sound engineering methods are applied.

3.1.6 Key Indicators

The key indicators of the impact of the proposed road on the wildlife resources were:

- distribution and movement of caribou
- population size (change)
- available habitat and habitat lost

- wildlife harvest
- road kills

The terms, no impact, moderate and major impact related to caribou are defined respectively as:

No Impact: The Ross Bay Junction-Churchill Falls Tote Road Project will not result directly or indirectly in the death of caribou.

Moderate Impact: The Ross Bay Junction-Churchill Falls Tote Road Project will result directly or indirectly in the death of caribou but not in a decrease of the population level, since the annual recruitment is greater or equal to the number of caribou dead.

Major Impact: The Ross Bay Junction-Churchill Falls Tote Road Project will result directly or indirectly in the death of caribou that will cause a decrease in the population level, since the annual recruitment is lower than the mortality.

3.2 Social Environmental Setting

The social environment in the context of this environmental assessment included the following components:

- Socio-economic study
- Tourism-recreation study
- Native Resource Use study
- Historic Resource study

The study area in general is a very sparsely populated region with settlements concentrated in the Labrador City, Wabush and Churchill Falls area. The population consists of Innu and settlers with approximately 80% of the people settlers (i.e., non-natives). The livelihood for most residents is derived either through basic natural resource extraction e.g., trapping, mining, the service industry supplying the population with consumer goods or from the government sector.

Due to their vastly different life styles and histories, the Innu and the settlers have not integrated to any extent, leading to a complex coexistence; more recently expressed through visible and severe differences.

There is a wide gulf between income of the settlers and that of the native people. Furthermore, in our investigation we observed a definite opinion split among the Innu population. About 40% wanted to return to the more nomadic aboriginal lifestyle while the other 60% (approximately) was eager to further develop a more 20th century economic base founded on resource harvest, tourism-recreation and manufacturing.

The most significant issue is an aboriginal land claim which lays specific ownership rights to a large expanse of Labrador including this study area. It has reduced even further the communication between Innu and "settler".

It is within this socio-cultural setting that the social environmental components of this EIA was examined.

3.2.1 Land Use and Controls

Current land use within the Study Area is shown on mapping found in Knight (1986).

Land within the Ross Bay Junction - Esker - Churchill Falls triangle is almost exclusively held by the Crown, with portion leased to private concerns. The major "formal" land users are:

- CFL Co.,
- QNS & L Railway,
- Cabin owners along the Esker Road between Churchill Falls and the Gabbro control structure and the Ashuanapi River, in the vicinity of Ross Bay Junction,
- a tourist operator, at Lobstick and members of the Innu Community at Lobstick and Lobstick Dam (fish plant).

CFL Co. holds 35 - 40 leases in the area, the largest of which is for approximately 51,800 ha at the power site. Leases for these lands are on a 99 year renewable basis.

In 1957, a 100 foot strip of land for the Esker Road right of way was transferred by license to Brinco with the right to develop and maintain the road for the term (99 year) of the water lease. The license was subsequently transferred to CFL Co. in 1985. The option was presented by the Newfoundland Government of changing the license to a fee simple grant, however, there is no record of this having been done (personal communications, M. Green C.F.L. Co. 1985). All of the land leased by CFL Co. is under mortgage, having been used as security for loans. If portions of this land were proposed for public use, the company's bondholders would have to be satisfied that CFL Co.'s rights to operate and develop would not be affected.

Cabin owners within the Study Area hold five year lease permits at a cost of $75.00/year. There are also a few trappers' tilts along the Esker Road, each pay a fee of $5.00/year.

The lodge at Lobstick is located on a 1.1 ha parcel, which is being held under a 50 year lease.

The Innu have used the Study Area for centuries for hunting and trapping. (Tanner and Armitage, 1986). There is an Innu community at Lobstick but it is not a permanent one. There is also an unused fish plant and related structures near Lobstick dam. The plant is, at present, unfinished and it would require an undetermined amount of investment required to reopen it (pers, comm. B. Boles, 1986). Camps are also set up on a regular basis along the QNS & L Rail line, (e.g., at Esker and Oraway and Pitaga, south of Ross Bay Junction).

Other land uses in the extended area include two fish camps in the Lac Joseph - Atikonak Lake area and cabin development at Ross Bay Junction.

3.2.2 Socio-Economics

For the purposes of this impact assessment, the Study Area includes the communities of Labrador City/Wabush; Churchill Falls; and Happy Valley/Goose Bay/North West River/Mud Lake and Sheshatshui. These are referred to respectively as Labrador West, Churchill Falls and Labrador East.

a) Demography

Rapid and erratic population growth was characteristic of all study area communities from the 1940's and 1950's to the mid 70's. This growth was attributed to rapid in-migration of labour to work in

i) the mining industry in Labrador West,

ii) construction of the hydro facility at Churchill Falls, and

iii) construction and operation of the military base in Goose Bay.

Population peaked in the mid to late seventies (Table 3.2.1.1) Decline in population has been caused by out-migration of labour due to:

i) decline in world market for iron ore and increased competition,

ii) completion of construction at Churchill Falls, and

iii) pull out of USAF from Happy Valley-Goose Bay.

The population of both Labrador City and Wabush has been declining since 1976 when it peaked at almost 16,000 persons. It's size in 1984 was approximately 13,800 people. (Knight, 1986). In general, the Study Area is characterized by a youthful population (Table 3.2.1.2). Compared to the provincial average, there are high percentages of children in the 0 - 4 age group, and fewer old people. Trends indicate that the population is maturing slightly and that a large number of young people are entering the labour force.

b) Housing

Housing in the Study Area is generally of recent construction and in fairly good condition. There is a wide mix of housing types in the three areas. High vacancy rates exist in Labrador West while there are none or very few vacancies in Churchill Falls. Mobile homes have been common in the past to accommodate large increases in population. In Sheshashui, housing built before 1978 is generally of substandard construction and in very poor condition.

c) Employment Conditions

- Labrador West (Labrador City/Wabush) - Employment is dominated by the primary sector (i.e., mining industry). The Towns have had a small tertiary sector which has recently begun to grow.

Table 3.2.1.1. Population Changes in EIA study area 1971 - 1984 (From D.W. Knight and Associates, 1986)

	Population Numbers					
Location	1971	1976	'71-'76 % Chng.	1981	'76-'81 % Chng.	1984
Labrador City	7,625	12,012	+57.5%	11,538	-4.0%	10,832
Walbush	3,385	3,769	+11.3%	3,155	16.3%	2,968
Churchill Falls	2,615	956	-63.4%	936	-2.1%	847
Happy Valley/Goose Bay	6,525	8,075	+23.8%	7,103	-12.0%	7,310
Northwest River	N/A	579	-	515	-11.0%	1,192
Sheshatsiu	N/A	515	-	503	-2.3%	
Mud Lake	86	70	-18%	72	2.8%	77

Table 3.2.1.2 - Age Group Distribution for Labrador Communities in 1977 and 1981. Numbers equal percentages. (From D.W. Knight and Assoc., 1986).

Age Group	Prov. Average	Lab. City		Wabush		Churchill Falls		HVGB		NW River		Sheshatshui	
	'81	'71	'81	'71	'81	'71	'81	'71	'81	'71	'81	'71	'81
0-4	8.7	17.5	13.0	18.3	9.5	6.7	21.0	16.4	10.0	14.6	10.1	14.7	15.0
5-14	21.2	23.1	22.3	20.8	27.0	13.7	24.0	30.0	24.0	30.4	17.1	30.4	28.0
15-24	20.0	21.3	20.0	21.5	15.5	20.2	18.3	18.1	21.8	17.4	20.2	17.4	27.0
25-44	27.4	32.2	36.6	34.0	38.2	36.6	36.0	27.0	31.4	21.2	27.3	21.2	23.0
45-64	15.5	5.5	7.4	12.4	8.0	20.6	16.7	7.3	11.0	11.4	16.1	11.4	6.0
65+	7.0	0.3	0.8	0.2	0.6	2.3	2.7	1.3	2.0	4.9	9.0	4.9	1.0

• Churchill Falls	Employment is primarily in the operation of the hydro facility.
• Labrador East - (Happy Valley/Goose Bay N.W. River/Mud Lake Sheshatshui	No sector dominates. The region has a more diversified economic base than in Labrador West. In Happy Valley/Goose Bay there is an emphasis on military and the general public service related to the town's function as the major administrative centre in Labrador.

Rates of unemployment are lower than might be expected in Labrador West as many laid-off people have left the region. Unemployment rates are generally much higher among females than males. Rates are highest in North West River and Sheshatshui. The largest percentage of unemployed are labourers.

Following are the number of unemployed (i.e., those in the labour force actively seeking work) as of March 31st, 1985.

Labrador City/Wabush	837
Happy Valley/Goose Bay	1,025
North West River	184
Sheshatshui	124
Mud Lake	N/A

d) The Innu Community:

The Community of Sheshatshui was used only as a summer camp site by the Innu (Naskapi and Montagnais Indians) until this century. The Provincial Government constructed wooden houses in the 1950's as part of an effort to settle the Innu. By the end of the 1950's, the majority of Innu had abandoned their nomadic existence and had taken up quasi-permanent residence in the village. Sheshatshui is governed by a Chief and a Band Council.

Individuals hunt and trap in the vicinity of the village and harvest firewood. During the Fall and Winter, many residents travel to the interior of Labrador, (in recent years via charter aircraft) to hunt caribou.

Innu recognize no proprietary interest to land and resources among themselves. They are subject to regulations and restrictions on their use of wildlife resources by the Provincial Government and resent this.

There are high levels of alcoholism and drug abuse. Criminal code infractions are abnormally high (personal communication, RCMP, North West River, Labrador).

e) Transportation

Rail Service:

Labrador City, Wabush and Churchill Falls are solely dependent on the QNS and L Railway for their surface transportation in and out of this area. The cost of freighting consumer goods from Sept Isles to Labrador City range from $19.14/tonne for vegetables, $27.97/tonne for furniture and general food stuffs to $37.40/tonne for fresh fruit. This is in addition to the transportation costs from major Quebec and Newfoundland terminals.

Rail passenger service is provided bi-weekly to Labrador City/Wabush and to Esker and Schefferville once a week and is the only rail service to the study area.

Marine Service:

The Lake Melville area's (Happy Valley/Goose Bay, N.W. River, Sheshatshui and Mud Lake) principal freight transportation link is by sea. CN Marine is the prime operator with four passenger-freight ferrys and five freight ships in operation. They sail from St. John's and Lewisporte up and down the Labrador Coast. In 1984, 51,914 tonnes were shipped to Labrador. Other firms operate ships which are used to distribute freight, fuel and to pick up fish. The Hudson Bay Co. charters several vessels per year to re-supply its stores throughout Labrador.

Approximately 95% of the cost of CN Marine services is subsidized. The approximate annual cost to the Government of Canada is $25.0 million. This kind of subsidy has been in effect since the beginning of the service and there are no plans to alter it.

The average tariff for transporting consumer goods by freighter is $21.0/tonne from Lewisporte and $32.0/tonne from St. John's. Wholesale charges and warehousing fees in Goose Bay increase the costs to between $45 to $54.00/tonne respectively. CN Marine annually carries about 2,250 passengers inbound to Goose Bay from Lewisporte and approximately 3,300 outbound passengers. About 2,000 passenger vehicles/year are transported between these points.

Air Service:

Two airlines service several of the communities examined in this study, namely Labrador City, Wabush, and Happy Valley/Goose Bay. Several local carriers provide service to Churchill Falls and Schefferville.

Air freight costs are extremely high with all of the cost being passed directly to the consumer through the retail pricing. Representative air freight rates to Wabush-Churchill Falls from St. John's are $1.56 to $1.80 per kg depending on the goods shipped. Perishable material such as produce cost the most.

Road Service:

Road travel of any type is very limited in Labrador since there are very few roads and their quality is usually very poor. Invariably one other mode of transportation must be used if one wants to drive, even to another major community within the "greater" study area. For example to "drive" to Goose Bay from Labrador City is a two day trip (760 km) requiring train travel to Esker then a second day drive from Esker to Goose Bay; at a total minimum cost of $500.00.

At present the significant road network is to the south from Labrador City-Wabush to Mount Wright on paved road then about 125 km south to Gagnon Quebec. Thirty more kilometers must be build to link the Quebec North Shore to Labrador City. Churchill Falls obtains about 1500 tonnes of goods shipped in trailer trucks via "piggy back" on QNS & L Railway to the Esker siding; from their trucks are driven to Churchill Falls.

A freight charge from Montreal to Churchill Falls , including the rail link from Sept Isle to Esker, is $200/tonne or $3,000/trailer.

CFL Co. maintains the Esker Road on a year-round basis. In addition to using the road for freight transportation, it provides access to the Lobstick and Gabbro control structures. A limited amount of goods, mainly construction materials and household effects, have been trucked to Churchill Falls, via the Freedom Road. We anticipate that this traffic will remain a "trickle" until the Freedom Road is upgraded.

f) Travel Patterns

The highest percentage of people who reported having taken no trips out of the community come from Churchill Falls, the most isolated of the three areas. CFL Co. gives generous travel subsidies to its employees but perhaps some of them prefer to use the cash for purposes other than personal travel.

The most common mode of travel is by air (Table 3.2.1.3) and the destination is usually Newfoundland (the island) (Table 3.2.1.4). Travel within Labrador is limited; only 21 of the people surveyed or 10 percent of trips were of this nature. Almost one third of all trips were to other locations or mainland Canada. An interesting point to note is how little use Labrador East residents make of CN marine (Table 3.2.1.3).

Table 3.2.1.3 **Main Modes of Transportation Used by Residents; based on survey talley. Numbers equal actual counts 1985 (from Knight & Associates, 1986).**

Method of Travel	Lab. West	Ch. Falls	Lab. East	Total
Air	56	38	89	183
CN Marine QNSSL	0	0	6	6
Railway	7	0	0	7
Car	2	9	0	11
TOTAL	65	47	95	207

Air travel dominates the transportation sector with all other forms making up a small percentage of the total. Some hypotheses which may explain this are that:

- the length of travel time required in using the combined marine train and car modes represents a considerable loss of time on a standard two week summer vacation, for any travel where time is limited.
- the high rates of pay and travel subsidies granted by IOC, Wabush Mines and CFL Co. to their employees mean that for most, the high cost of air travel is not prohibitive, therefore whey spend more time getting there.

Table 3.2.1.4 **Total Number of Trips by Destination for Study Area. Numbers are actual survey counts 1985. (D.W. Knight and Assoc. 1986)**

Destination	Location Lab. West	 C. Falls	 Lab. East	Total Sample
Labrador	0	11	10	21
Newfoundland	37	27	34	98
Canada	19	2	48	69
Elsewhere	9	7	3	19
TOTAL	65	47	95	207

Approximately half the trips within the Study Area were for vacation purposes and a large number (42%) were for business. No trips were taken primarily to shop. Only a small number (7%) of total trips had as their main reason visiting friends and family. However, it is highly probable that a large number of those going on vacation to Newfoundland were also going to stay with family members.

g) Transportation Related Problems

As part of the economic services survey (Knight & Assoc., 1986), businessmen were asked to comment on current problems experienced in transporting goods into their area. The major problems were:

- damage to goods in Labrador East (95%)
- loss of goods; 39% in Labrador West; 55% in Labrador East
- food spoilage; (30%) or outdated goods (45%), in Labrador East
- delays in receiving goods; 75% in Labrador West; 95% in Labrador East
- the high proportion (46%) of businesses in both East and West had problems with the availability of items.

3.2.3 Key Indicators

The magnitude of impacts resulting from the construction of the Tote Road was based on the comparison of values of the different indicators before and after development. Olsen and Merwin (1977) provide a formula which is constructed as follows:

Impact = indicators at time 2 with project - Indicators at time 2 without project

It is important to note that the impact is not purely a change in the existing condition of that indicator but a measure of what the future condition would be beyond the normal change with time.

The key indicators used in the Socio-Economic Study were:

- location of markets
- sources of materials
- income levels
- population size (work force)
- type and condition of housing
- vacancy rates
- degree of isolation experienced (subjective)
- types of transportation
- volumes of passengers
- rates for freight movement
- fares for passengers/vehicle movement
- travel times
- goods transportation and service deficiencies
- current travel patterns

3.3 Tourism and Recreation

3.3.1 Facilities

The tourism plant in the Study Area consists of:

a) four hotels, with an average occupancy rate of 30 - 40% in the 1983-84 season.

b) Duley Lake Provincial Park, which operates at capacity during the summer months.

c) three fish camps, at Lobstick, Atikonak and Kepinets Lakes.

The Labrador West Tourism Association was established in 1982 and has recently prepared a Tourism Development Plan.

3.3.2 The Market

The existing tourist (recreation) market in Labrador is small. For 1983, non-resident visitors (both auto and air) were estimated at around 7275, with an additional 10 to 12,000 tourist trips taken by residents. Total tourist-related trips were estimated between 17 and 20,000 for the June to September period. By way of comparison, Nova Scotia experienced slightly over one million non-resident trips alone over the same period in 1983.

Given the relative inaccessibility of the Study Area by car from coastal Labrador, it is assumed that less than half of the number of trips to Labrador were made to the Study Area. The majority of trips in the Study Area vicinity would have been made by air.

Non-resident tourist-related expenditures over the 1983 June to September period are estimated by the provincial Department of Development and Tourism at around $3,091,300. Of this amount, $581,300 was spent by auto travellers, and $2,510,000 by air travellers or about $104 per Labrador resident. This compares to about $216 for each Nova Scotian resident derived from non-resident expenditures in that province. Looked at in this light, the tourism contribution to Labrador's economy is highly significant. No estimates are available for resident tourist-related expenditures.

3.3.3 Resources

a) Fishing/Trapping/Hunting

Aside from the Ossakmanuan reservoir and several stream crossings, the area does not represent an exceptionally unique fishing opportunity (LGL Ltd., 1986) albeit it is wilderness fishing. Most of the lakes and rivers in the area support populations of common sport fish and have good tourism/recreation amenity value. In addition to Lobstick Lodge, there is only one active fish camp presently operating in the region surrounding the Study Area (at Atikonak Lake).

Estimates from interviews with operators indicate that approximately 1000 clients (all non-residents) used the three known Labrador fish camps over the 1984 season.

There has been a provincial freeze in effect over the past several years on the establishment of fish camps. This policy is currently being studied and may be changed in the near future.

Trapping contributes about $245,000 annually to the regional economy.

In the study area, both moose and caribou are protected therefore they offer little in terms of hunting opportunities. However, the George River caribou herd north of the study area, with a population of 600,000-750,000 animals has been opened to restricted commercial hunting geared to the "fly-in" market. One operator in the western part of the study area has been given the permit to conduct hunts.

Five other operators are from Goose Bay. The hunt quota for 1985 was 6,000 caribou.

b) Cabin Development

Along its west and northern boundaries, the Study Area has seen extensive cabin development by the resident population. The cabins are used for passive recreation, sport fishing and small game hunting. An estimate of the number of cabins in the Study Area is around 171. This means roughly a ratio of one cabin for every four households for the combined Labrador City/Wabush and Churchill Falls area.

Since completion of the Tote Road to Ross Bay Junction, there has been a high demand for cottage lots in the area, particularly on the Ashewanipi River. Interest has been expressed by the resident population for additional cabin permits. There is presently a Provincial Government restriction on cottage development at Labrador rivers.

c) Other Tourism/Recreation

At this point passive recreation (i.e., naturalist activities or wilderness camping) is minimal in the area principally due to the high cost of getting to access points (e.g., canoe routes) from the larger centres in Labrador.

3.3.3 Indicators

The key indicators used in the study were:

i) levels of resident and non-resident travel
ii) use of tourist operations, (fish camps, hotels, parks, etc.)

iii) levels of resource harvest

iv) numbers of recreational vehicles owned by residents and non-residents

v) number of cabins along old and newly constructed roads.

3.4 Native Resource Use

3.4.1 Innu Cultural Values

The Innu of Labrador and Quebec, comprising approximately 9,000 people, are based in the communities of Davis Inlet, Sheshatshui, St. Augustin, La Romaine, Natashquan, Mingan, Sept-Isle/Maliotenam, Schefferville (Matimekush and Kauauatshikamatsh), Bersimis, Les Escoumins, and Pointe Bleue. The Innu, together with the Cree, are part of a linguistic and cultural continuum which stretches from the coast of Labrador to as far west as the Rocky Mountains. Regional groups with homelands in the interior live adjacent to one another, and have cultures and dialects which are closely similar. Thus, although settlements like Davis Inlet and Sept-Iles are considerable distance apart, the bands associated with them would meet and live alongside each other in the interior, and their dialects are mutually comprehensible.

The culture of the Innu is adapted to life in the boreal forest of northern Canada, and is based primarily on the exploitation of large game such as caribou, moose, and bear, fur bearing animals such as beaver, martin, mink, otter, lynx and muskrat, small game such as hare and grouse, fish and waterfowl such as ducks and geese. These animals are still harvested, not just for their dietary or commercial fur value, but because through hunting people achieve status and a worthwhile life style. In addition, materials used to make clothing, tools, medicines and other items used in everyday life can be obtained.

In short, hunting and other harvesting activities are highly valued by the Innu because they are both economic activities and religious events which give meaning and expression to most aspects of life. Since the Innu place such importance on maintaining the environment, whatever can be done to enhance their culture will also be of benefit to all who value a sound environment.

3.4.2 Innu Toponyms

Apart from travel routes, meeting places and burial places, the cultural value of the study region is also reflected in the great number of Innu toponyms for the various geographical features located there. A list (although only a partial one, since we were unable to interview most of the primary users of the region) is given in the Component Report (Tanner and Armitage, 1986). There are Innu names for most if not all of the lakes, rivers, and mountains in the area, as well as for swamps, islands, portage routes, and other features.

These Innu toponyms add to the evidence of lengthy and continuous occupation and use of the area by the Innu, and demonstrate how detailed their knowledge of the land is.

3.4.3 Level of Resource Harvesting

Following recent restrictions on Quebec-based Innu hunting in Labrador, most of the Innu harvesting activities in the study area have been limited to those in two localities: (1) along the road between Churchill Falls and Esker; (2) along the railway between Sept-Iles and Schefferville.

The present pattern of reduced Innu land use has come about because of new conditions that have developed in relatively recent years. Up until the 1960's, entire Innu families would go into the interior for eight months a year. Later, because of the demands of schooling, some Innu men began to hunt without their wives and children. The Innu using the area of the proposed road were based mainly in the communities of Schefferville and Sept-Iles/Maliotenam, and to a lesser extent, Mingan. They travelled into the interior by way of the new railroad, and later by snowmobile and aircraft. In the post-1960 period, they tended to stay inland for shorter periods than before, and concentrated their efforts on large game and fur species. As fewer women and children participated in these harvesting activities, proportionately less of the harvest came from small game species and fish. Exploitation of the Lac Joseph herd may well have increased initially, at least as long as the herd size remained large, due to easier access to the caribou hunting region made possible by the new methods of transportation.

In the most recent period, there are indications that Innu in the study region, like Innu elsewhere in the peninsula, have now returned to the family style of land use, and women and children are once again active participants in wilderness-based harvesting activities.

Annual Harvesting Cycles

The Innu spend the fall fishing for lake trout and other species, hunting grouse and hare, and trapping beaver, martin, mink and fox. Some moose and caribou are killed, even though this is illegal. Many of the Quebec-based Innu turn their attention to caribou hunting in the region north of Schefferville, during the months of January to March, where, (in Quebec), caribou hunting is legal for them. Some harvesting activity also continues along the railway during the mid-winter months by groups of Innu, but it is difficult to estimate how much. For example, the Wildlife officer at Wabush encountered two young men from Sept-Iles/Maliotenam in February, 1985, living in a cabin near Esker, and harvesting animals in the vicinity. They had licences which allowed them to hunt small game, and trap all fur bearers except beaver. Other Innu from Quebec now purchase non-resident trapping licences as well. In the spring, hunting continues along the railway for small game, muskrat, migratory waterfowl and fishing. Mixed small game hunting and fishing are typical of the harvesting pattern during the summer months.

Harvest Estimates

On the basis of available information, we estimate that there are about ten Innu families engaged in harvesting activities along the railway in this vicinity of the study area, in addition to the existence of a number of all-male hunting parties, and that the ten families spend on the average the months of September, October, November, April, May, June, July and August harvesting in this region. At the Esker Road and Lobstick Fish camp region there is an average of another 10 families using the area.

We are able, then, to arrive at the following crude estimate of the present harvest by Innu using the study area, that is, Innu engaged in harvesting activities along the railway and on the Esker road (Table 3.4.1 and Table 3.4.2). Fish, fur bearers and spruce seem to be the most heavily harvested wildlife. These estimates are probably conservative since the allowance made for the harvest of the all-male hunting parties along the railway, and the Innu families and all-male groups from Sheshatshui who hunt along the Churchill Falls to Esker road may be on the low side.

Table 3.4.1 Present Harvest for each part of the Road Area (from Tanner & Armitage, 1986)

Species	Numbers of animals harvested in the Esker Road area: Mile 61 Oct.-Dec.	Mile 61 Jan.-mid-May	Lobstick mid-May-Sept.	Total Esker Road	Numbers of animals harvested in the Ashuanipi area: Family Sept.-Dec.	Family April-Aug.	All-male Jan.-Mar.	Total Ash-uanipi	Total both areas
Caribou	3	2	3	8	10	-	3	13	21
Moose	-	-	-	-	5	5	3	13	13
Bear	1	-	2	3	5	5	-	10	13
Beaver	60	20	5	85	120	10	15	145	230
Mink	60	-	-	60	120	-	72	192	252
Martin	120	-	-	120	240	-	108	348	468
Weasel	120	-	-	120	240	-	72	312	432
Otter	5	-	-	5	20	4	-	24	29
Lynx	2	-	-	2	2	-	6	8	10
Fox	2	-	-	2	10	-	9	19	21
Muskrat	200	-	-	200	300	200	0	500	700
Porcupine	5	20	5	30	20	10	9	39	69
hare	120	60	10	190	120	90	108	318	508
Grouse	120	600	200	920	360	540	180	1,080	2,000
Geese	-	-	10	10	-	120	-	120	130
Ducks	-	-	200	200	20	400	-	420	620
Owls	2	-	2	4	2	10	-	12	16
Loons	-	-	10	10	5	10	-	15	25
Pike	-	-	20	20	120	180	-	300	320
Suckers	-	-	40	40	120	900	-	1,020	1,060
Whitefish	-	-	-	-	100	180	-	280	280
Trout	120	600	2,000	2,720	400	900	36	1,336	4,056

Note: The amounts shown for the Whitefish harvest do not include Whitefish harvest in the commercial fishery at Lobstick Lake (see the Socio-economic component study for informtaion on this harvest).

Table 3.4.2. Present dollar value of Innu Harvest for Entire Road Area. (See Table 3.4.1 for "Number" derivation, from Tanner & Armitage, 1986).

Species	Number	Edible food/ animal (kgs)*	Total food (kgs)	Mean Value	Total Value
Caribou	21	58.00	1,218		
Moose	13	188.67	2,453		
Bear	13	95.00	1,235		
Beaver	230	6.78	1,559	$ 22.00	$ 5,060
Mink	252	N/A		23.00	5,796
Martin	468	N/A		50.00	23,400
Weasel	432	N/A		1.50	648
Otter	29	4.75	138	53.00	1,537
Lynz	10	4.00	40	328.00	3,280
Fox	21	N/A		65.00	1,365
Muskrat	700	.64	448	5.00	3,500
Porcupine	69	4.76	328		
Hare	508	.84	427		
Grouse	2,000	.35	700		
Geese	130	2.10	273		
Ducks	620	.77	477		
Owls	16	N/A			
Loons	25	1.08	27		
Pike	320	1.38	442		
Suckers	1,060	.20	212		
Whitefish	280	.46	129		
Trout	4,056	2.05	8,315		
Total edible meat			17,073 kgs.		
Total fur cash value					$ 44,586
Total cash value of subsistence food** (1985 dollar replacement cost @ $6.00 per kg.)					110,286
Total estimated cash value of food and furs harvested					$154,872

Notes:

* Mean food weight per animal are taken from Weinstein 1976:95-98.

** For a discussion of the value of subsistence food, see Usher 1976.

- No estimates of the monetary value have been included for the following items which are also harvested by the Innu in the Tote Road region:

1. Caribou, bear and other skins and furs kept for their own use by members of the household, or for the manufacture of commercial handicrafts.
2. Firewood.
3. Wild fruit.
4. Wood used to manufacture household products, or used in commercial handicraft production.

3.5 Historic Resources

Historic resources are non-renewable and are categorized as objects or localities which are important to the understanding of past events. The historic resource sites can be either paleontological, i.e., fossilized remains as evidence of early prehistoric activity representing occupation of the land before Europeans of which the earliest contact reported is 1695 AD or historic after contact between early peoples and European explorers and settlers.

The study area is dominated by Innu travel routes which intersect both the proposed and alternate routes at a combined total of 8 locations, four on each of the routes (see Figure 3.5.1 Appendix).

A review of ethnographic, historical and exploration literature dealing with this part of Labrador suggests marginal occupation, at least during the historic period. This conclusion, however, has been qualified by Penny, (1986) based on archaeological surveys in other areas in which the Innu lived and established a significant number of sites. Tanner and Armitage (1986) point out that there is every indication that the historical routes and meeting places as shown on Figure 3.2.1.1 Appendix, have remained important up to the present, since the criteria used by the Innu for camp sites and travel routes have not changed; the transition from paddle to outboard or dog team to snowmobiles and airplanes, has made little difference.

Penny's survey results revealed only one site, a small historic camp site along the proposed route. Penny notes that it is most likely the result of a single overnight occupation during the past couple of decades. There were no artifacts except for a wooden span used to set a camp stove on. There was no iron or lithic debris found in the test pits or on the surface. Penny also notes that there was evidence of human activity in the study area caused by axe chopped trees found in numerous locations along both the alternate and preferred routes. The oldest cuttings were estimated to date from the turn of this century. Cuttings were found at most locations where the corridor approached or skirted a body of water (trees were cut for a variety of reasons, i.e., fire wood, dead fall traps, portages, and as markers).

Penny's findings are consistent with the work of Thompson (1983, 1984) on the first 68 km of the existing Tote Road. Penny (1986) concluded that while the probability of subsurface prehistoric sites within the survey cut areas of the proposed route is low, the probability of sites along the shorelines of rivers and ponds in the vicinity of both road corridors appears high. These findings echo the results of other recent work (Beak Consultants Ltd. 1980) related to the transmission line proposed by the Lower Churchill Development Corporation Ltd. in 1980. In 1983, Thompson found one prehistoric artifact which has been destroyed by the mining operations at Wabush. He found three historic sites of low cultural significance as well. In 1984, a small historical camp site near Lower Creek was located and was probably the result of a single occupation by an Innu family during the past several decades.

Fitzhugh (1972) on the other hand suggested that, based on the material culture of the Innu, less than 1% of any site would be preserved in the subarctic climate and acidic podzol soils. This is because in this region, within a 50 year time span, all but stone artifacts decay (the majority of Innu tools were of bone).

In conclusion, the probability of finding and destroying archaeological, sites along the proposed or alternate corridors is remote.

3.6 Valued Ecosystem Components

This environmental assessment consisted of seven component studies dealing with specific ecosystem components such as climate, vegetation, historic resources, etc.

Based on the results of these studies, as described in Sections 3.1 - 3.5, several components and subcomponents stand out as being significant both in term of their sensitivity to the undertaking and the preceived effects. The estimation of the impacts focussed on these components albeit all components were used in selecting a preferred alternative.

3.6.1 Natural Environment

In the context of this EIA, the valued natural environmental ecosystem components are:

- the wildlife population and their harvest
  - caribou
  - fur bearers
  - waterfowl
- maintenance of fisheries habitat
- the wilderness experience

It is not so much the construction of a road that will affect these components, but rather the future access to previously remote areas.

3.6.2 Social Environment

In the context of this EIA the valued social environmental ecosystem components are:

- Regional Economics
  - employment
  - cabins/services
  - cost of transportation

- Tourism/Recreation
  - hunt/fish camps
  - passive recreation
  - wilderness experience

- The Innu
  - subsistence harvest
  - land use pattern maintenance

In the case of the social environment, it is the change in access affecting the time, ease and cost of transportation and travel that will be a major impact on the socio-economic environment. A road and the associated new access will be particularly pertinent with respect to impact on existing Innu land uses.

3.7 Special Areas

No International Biological Program (I.B.P.) sites lie within the study corridors of either the proposed or alternate Tote Road routes. Two sites (Thomas Falls and Churchill Falls) are located 10 and 15 km distant respectively west of the proposed route, and Menihek Lake, is 15 km north of the alternate route. Descriptions of these three sites are given below. Appendix E shows the locations of the sites in relationship to the two alternate Tote Road routes.

Menihek Lake (I.B.P. No. 8-37)

Coordinates: 53°48-51'N 66°15-25W
Status: Supplementary Site
Size: 32 km^2
Description: Linchen forest (white spruce - vaccinium - cladonia) on glacial drift, some peatland.
Approximate distance from road corridor: 15 km

Thomas Falls (I.B.P. No. 8-70)

Coordinates: 53°31'N 64°30'W
Status: Low priority. No other information given.
Approximate distance from road corridor: 10 km

Churchill Falls (I.B.P. No. 8-57)

Coordinates: 53°26'N 64°18'W
Status: Special Site.
Size: 0.7 km^2
Description: A complex forest and fen developed under the influence of the spray from Churchill Falls so that there are great differences over short distances.
Approximate distance from road corridor: 15 km.

4. EVALUATION OF ALTERNATIVES

This chapter documents the planning and design alternatives and specific construction requirements which were considered to meet the needs and any environmental concerns associated with the provision of a surface transportation system in Labrador. Furthermore, in this chapter, we select the preferred alternative concept and the preferred alignment.

4.1 Alternatives to the Tote Road

4.1.1 Do Nothing

The Do Nothing Alternative is to continue with a discontinuous road system in Labrador which necessitates a multi-modal trip, i.e., road and rail in order to travel to Central Canada, to the Island of Newfoundland or between Churchill Falls, Lake Melville and Labrador West.

The advantages of this condition are few and generally revolve around the fact that the time and dollar costs are generally borne by the consumer and the Quebec North Shore and Labrador Railway. Travellers have to organize the trip, preload a vehicle on the train, possibly wait for the vehicle to arrive, spend extra nights on the road in the context of a two or three week vacation. Up to this point rail passenger service on the QNS&L Railway has not received a government subsidy. The QNS&L has applied to discontinue its passenger service. However, the Canadian Transportation Commission (CTC) has not seen fit to grant this request. As long as there is no government subsidy the Status Quo is financially beneficial to the government as the costs of passenger transportation are borne by both the consumer and the railway. The advantage of the Status Quo, however, starts to evaporate if a government subsidy is required on the QNS&L Railway.

The disadvantages of the Do-Nothing Alternative are that it maintains a high cost of living in Labrador (which has the highest cost of living in the province). The status quo maintains the isolated condition of the Labrador communities thus making it difficult to attract and keep staff for government, business and industry.

4.1.2 Rail Link

In 1979, the Newfoundland & Labrador Department of Transportation commissioned DeLCan, De Leuw Cather, Canada Limited to prepare a feasibility study on a Trans-Labrador Railway. The potential for the use of rail transport by the forest industry, hydro development, mining industry, and others was used to develop three technically feasible railway corridors.

The Iron Ore Company of Canada and Wabush Mines indicated that they had no interest in a new rail line because of the existing railway and facilities at a port on the Quebec Northshore which was open all year round. Of all the other commodities to be found in Labrador only uranium was likely to be mined. This commodity would make very little use of a railway.

Capital costs were developed for the various alternatives. The estimated construction cost of the recommended composite route (several resource extraction and energy production industries) in 1980 was $1,258.7 million. In addition, the cost for three locomotive units, 140 cars and 2 cabooses, was approximately $7.4 million. Operating and maintenance costs for the railway were estimated based on similar operations in North America. Potential revenue from the lumber industry and the future hydro developments were estimated at $12.63 million per year. This was considered insufficient to cover the operating and maintenance costs. Approximately 2 million tons of iron ore annually would have to be shipped out of Labrador City area to enable the potential revenues to balance the operating and maintenance costs. To recover 5% of the capital costs over 20 million tons of ore would have to be hauled annually on the new railway across Labrador. This would displace approximately 57% of the 35.1 million tons of ore carried by the QNS&L Railway in 1977.

4.1.3 Roadway

In 1974, the Newfoundland and Labrador Department of Transportation commissioned R.J. Noah and Associates to prepare a report on the benefits and costs of the Quebec-Trans Labrador Highway. This report considered the benefits of building the road in:

- accelerating developments such as iron ore mining, the fresh water fishery, forestry, the secondary and service sector, tourism & agriculture by providing relatively cheap access and transport of goods.
- savings to new developments such as hydro power development, offshore oil and gas and the exploration and development of other minerals by providing transportation and access.
- savings to the existing developments and services such as the sea fishery, currently operating industries and services, freight savings to shippers (based on diversion from air, ship and rail), reductions in subsidies on CN Coastal Service and the Gulf Services as well as the reduction in UI payments through the creation of new and year-round jobs.

Noah and Associates concluded that: "The total of quantified benefits in terms of 1984 present value added and savings is $3,523.8 million plus $455.0 million from highway construction and $13.6 million from highway maintenance. Hence, the total benefit amounted to $3,992.4 million. Costs include highway construction at $1,300 million and highway maintenance at $34.1 million, for a total of $1,334.1 million in 1984, in present worth terms. Thus, the direct quantified benefits/cost ratio is approximately 3:1." Noah emphasizes that the cost component was derived based on highway costs from the Sagueney to Gros Morne Park roadway, whereas the benefits component was generated using Labrador data. The present worth benefit of $3,992.4 million is comparable to a uniform cash flow of $468.9 million per annum for 20 years at a 10% interest rate. Expressed in similar terms the costs of highway construction and maintenance amount to $156.7 million per annum. Hence, the net annual benefit resulting from the highway can be conceived as the difference between these two annual cash flows, i.e., a value of $312.2 million per annum.

4.1.4 Summary

For Central Labrador, with extremely high travel costs and severe isolation, maintaining the Status Quo or a "do-nothing" alternative is not acceptable. No objectives are met and no one benefits. In the long term, economic losses would result.

The rail alternative is an economic loss. With both the lumber and hydro industry using the railroad and with the mining industry shipping more than half of its ore on the new rail service, capital costs would not be paid back in less than 20 years. As well, this would mean a displacement of more than 50% of the existing freight shipped via the QNS&L Railway. The undertaking would experience a chronic net loss.

A roadway is the only viable alternative as it meets the need of public transport, low cost and easy access the best. Based on this examination, the road link was chosen as the only viable approach to upgrading the transportation network in Labrador.

4.2 Design Alternatives

The Labrador Tote Road will complete the road link between the Goose Bay - Happy Valley area and Wabush - Labrador City. Construction of 68 km of similar road has been completed eastward from Wabush to the Ross Bay Junction on the QNS&L railroad. Two routes, a Proposed route and an Alternate route, have been considered as alternative designs for the Tote Road. (See Appendix "C" for details of the alignments).

The Proposed route follows a direct line from the Ross Bay Junction (68 km) to the existing Esker Rod (199 km) near the Churchill Falls access road intersection. The construction of 131 km of new road will be required.

The Alternate route parallels the QNS&L Railroad from Ross Bay Junction (68 km) and connects to the existing Esker Road (157 km) near Esker. This route requires the upgrading of 100 km of the existing Esker Road. The construction of 89 km of new road and the upgrading of 100 km of the Esker Road produces a total driving distance of 189 km.

The Proposed route would require the construction or reconstruction of less road (131 km versus 189 km) and would provide a corresponding shorter total driving distance of 58 km (1 hr.)

4.2.1 Engineering

i) Road Design Strandards:

Both alternatives have the same design standards.

The horizontal alignment will be designed to a Rural, Collector, Undivided, 80 km/h (RCU 80) Standard (RTAC 1976). The minimum radius of curves will be 230 m with a maximum profile (vertical) grade of 5 to 8%. The profile grade will generally be 6% with a few grades of 8%.

The road right-of-way will be 40 m wide, within which a 20 m wide area will be cleared and close cut. With close cutting, the roots of the existing vegetation cover are left in place, to minimize erosion of the original ground.

The road will be constructed with a minimum fill depth of 500 mm and a width of 9.0 m. This will be supplemented by a 500 mm deep by 6.0 m wide granular driving surface where strengthening of the road base is required.

Where excavation is necessary, the original ground will be stripped of topsoil and vegetation before excavation to reduce frost action in the subgrade and subsequent roadway deterioration.

Adjacent to natural water courses, drainage of water along the right-of-way will be accomplished by ditches excavated parallel to the toe of the road slope. Water will be directed to natural water courses after passing through vegetated areas, either existing or revegetated.

ii) Bridges and Structures:

Major watercourses crossed by the Tote Road will be carried in arch plate structures/arch plate pipes or circular/elliptical culverts. Bridges will be required for the larger streams or rivers.

On the Proposed route, bridges are anticipated at the following locations:

a) Miron River (85.5 km)
b) Unnamed River (138.0 km)
c) Ossokmannan Lake (157.0 km)

There are approximately 11 crossings requiring arch plate structures or pipes and 5 crossings requiring culverts.

On the Alternate route, bridges are needed at the following locations:

a) Miron River (86.5 km)
b) Bernadette River (103.5 km)
c) Every River (121.5 km)
d) Wide River (130.0 km)
e) Unnamed River (147.5 km)

In addition, there are 2 crossings requiring culverts.

Other minor watercourses crossed by the Tote Road will be carried in culverts.

iii) Construction Planning:

Construction operations will be influenced by the location of borrow material since the project is primarily in fill. A common source of acceptable fill may be found in the granular deposits known as eskers. These deposits are found at Ross Bay Junction 68 km, on the proposed route at 110 km, 158 km and 174 km, and on the alternate route at 138 km and 147 km. Some of these borrow sites can be used for construction camps. In addition areas of hummocky moraine, as found at various locations, may contain acceptable borrow material.

The initial construction contracts will be about 20 km in length. Construction contracts for the proposed route will be from 68 km - 92 km (1986), 92 km - 110 km (1987) and 110 km - 153 km (1988-1990). Future contracts would run from 153 km - 174 km and 174 km - 199 km. Construction camps for the proposed route could be located at 68 km, 110 km and 174 km.

The alternate route will be divided into contracts from 68 km - 92 km (1986), 138 km - 157 km (1987) and 92 km - 138 km (1988-90) with construction camps at Ross Bay Junction 68 km, 138 km and 157 km.

iv) Construction Scheduling:

Construction is anticipated to be completed within the time frame specified in Table 4.2.1.5.

A construction year is based upon the period from June to October during which it is expected that the construction areas would be ice free. This time frame also avoids the May-June calving period of the caribou.

Table 4.2.1.5 - Construction Schedule

Contracts Proposed Route	Construction Camp Location	Contracts Alternate Route	Construction Camp Location
First Year (1986)			
68 - 92 km Bridges & Structures (1)	68 km	68 km - 92 km Bridges & Structures (1)	68 km
Second Year (1987)			
92 - 110 km	110 km	138 km - 157 km Bridges & Structures (1)	157 km
Third Year to Fifth (1988 - 1990)			
110 - 153 km Bridges & Structures (1)	110 km	92 km - 138 km Bridges & Structures (3)	138 km
Sixth Year			
153 - 174 km Bridges & Structures (1)	174 km	Upgrading Esker Road	157 km
Seventh Year			
174 - 199 km	174 km	Upgrading Esker Road	157 km

v) Labour Requirements:

Each road construction contract should employ approximately 30 persons, with each bridge utilizing 10 persons. The construction labour can be summarized as follows:

Construction Year	Proposed Route	Alternate Route
1st year	40 persons	40 persons
2nd year	40 persons	40 persons
3rd year	30 persons	40 persons
4th year	30 persons	40 persons
5th year	30 persons	40 persons
6th year	40 persons	30 persons
7th year	30 persons	30 persons

For summer maintenance purposes permanent depots will be established at Ross Bay Junction (68 km) and at 174 km on the proposed route or 157 km on the alternate route. Each depot would employ, on a seasonal basis, about 12 persons. Winter maintenance, if applicable, would require the establishment of an addition depot at 138 km, on the proposed route, or 110 km on the alternate route.

vi) Costing:

The construction cost of the proposed route is estimated to be $300,000/km; the alternate route $350,000/km. The major differences in the two routes are the extra bridges or structures on the alternate route, which is only partially offset by the fact that the alternate route parallels the QNS&L railway for 45 km which reduces mobilization expenses. The existing route will also require the upgrading of a portion of the existing road to Esker. This will raise the standard of the Esker Road to the same level as the new construction of the Wabush to Russ Bay Junction portion.

The cost for the proposed route is as follows:

Construction		$300,000/km x 131 km	=	$ 39,300,000
Engineering	10%			3,900,000
				$ 43,200,000
Contingencies	10%			4,300,000
	TOTAL			$ 47,500,000

The cost for the alternate route is as follows:

Construction		$350,000/km x 89 km	=	$ 31,200,000
Upgrading Esker Rd.		$100,000/km x 100 km	=	10,000,000
				$ 41,200,000
Engineering	10%			4,100,000
				$ 45,300,000
Contingencies	10%			4,600,000
	TOTAL			$ 50,000,000

vii) Operation:

The Ross Bay Junction to Churchill Falls Tote Road is proposed as a seasonal road in operation from the end of spring breakup to early fall when snow clearance requirements prohibit its use.

Neither the proposed route (131 km) nor the alternate route (new 89 km) would be cleared of snow to permit winter operations. The Churchill Falls (Labrador) Corp. (CFL Co.) does clear snow on the section of the Esker Road (100 km) scheduled for upgrading as part of the alternate route. The CFL Co. utilizes the Esker junction on the QNS&L Railway for shipping supplies into Churchill Fall. It is not anticipated that CFL Co. would utilize Ross Bay Junction if the proposed route were constructed.

4.2.2 Review of Identified Concerns (by the public and the Crown)

Following two week-long sets of open-house public information sessions (Boles, 1986), recorded public concerns were few. There appeared to be an even division among those who were concerned that the project was not under construction sooner, providing jobs and revenue to the local economies and those who feared that their historical use of the land would be further reduced by the project. There were practically no negative concerns expressed by any public provincial agency or municipal government other than the Innu Association at Sheshatshui.

When possible, the study team responded to any public concern or question "on-the-spot" during a specific meeting (Boles 1986). If that was impossible, written replies were mailed out once the appropriate study team member was consulted. Each meeting was recorded in its entirety and later transcribed to form a part of the public participation component report (Boles 1986). Major questions which arose during the first round of information sessions were answered during the second set of meetings held some six months after the first set.

4.2.2.1 Summary of Concerns:

i) Soil, Geology and Vegetation

No concerns were expressed with respect to the soils geology and vegetation which might be removed, buried or rendered inaccessible. The component consultant (DeLCan, 1986) did warn of possible nutrient leaching problems associated with exposed borrow pits resulting in poor revegetation potential for these areas once the extraction was over. Loss in terms of merchantable timber was considered negligible.

ii) Aquatic Resources

Minor public concerns were expressed concerning the potential fishing activity at stream crossings, i.e., abundant sport fish at newly accessible water crossings could be rapidly "fished out" (LGL, 1986). This concern was expressed principally by the Innu who have used the waters throughout history and now see a rapid resource depletion taking place.

No other group or agency expressed any specific concerns regarding the impact on these resources.

iii) Wildlife Resources

Significant public concern (principally by the Innu) was expressed over the potential further degradation of the already critically small Lac Joseph caribou herd (St. Martin and Theberge, 1986). New and closer access points to the herd could increase the potential for further poaching (no caribou hunting is permitted in this area) and be the final blow to the herd's survival.

Provincial Wildlife Division personnel suggested that the Lac Joseph herd was on the decline and that any further population depletion or loss of presently used habitat (there was no evidence of that occuring, (St. Martin and Theberge, 1986)) could seriously affect the herd. The component consultant presented data to suggest that the herd is precariously small and any further man-made interference could mean its total loss (St. Martin and Theberge, 1986).

iv) Native Resource Use

Significant public concerns were expressed about the potential reduction in the natural resource necessary for the subsistance harvesting practiced by the Innu. The arguement was presented that given a new road non-native recreational hunters, trappers and fishermen would have easy access to the traditionally native area (historically, land occuppied for centuries by the Innu) and would harvest a disproportionately high percentage of the wildlife resource. The Innu would be left with a smaller total harvest and smaller, already meager income.

A less tangible but far more serious concern expressed dealt with the impact of the road on Innu society and culture due to "the central role that hunting (resource harvesting) plays in Innu life". The road was seen as a further attempt to draw the Innu closer to the "Euro-Canadian" society hastening the erosion of their culture and values which revolve around hunting (Tanner & Armitage, 1986). The strengthening not the dilution of the Innu hunting way of life "represents the only realistic alternative to the numerous social problems that are evident in the villages" (Tanner & Armitage, 1986).

The interviews conducted by the component study team (Tanner & Armitage, 1986) echoed these concerns.

v) Socio-Economic Conditions

No significant negative concerns, associated with the proposed roadway, were expressed by the public or the government agencies. The road was seen as an economic stimulus to all sectors of the Labrador economy. Socio-culturally the road was viewed as a benefit fostering de-isolation and improving communication. Generally, these findings echoed the Euro-Canadian's (80% of the population) perspective and not the concerns of the Innu (see Tanner & Armitage, 1986).

The negative comments concerning the projects dealt with the long lag-time between project announcement and actual start-up bringing economic stimuli to the Labrador communities which would serve as construction staging areas and supply depots for the project. Changes in the federal transportation subsidies as a function of the new road was seen as a potential bottle neck but not an insurmountable blockage.

vi) Tourism - Recreation and Resource Use

Due to the weak state of the tourism - recreation infrastructure in Labrador, e.g. only 200 motel units, the project will have little impact on this socio-economic sector. Only with a large increase in marketing and promotional activity in Labrador would the road significantly boost the tourism - recreation use of the area.

Concern was expressed that the road would stimulate more recreational hunting and trapping, thereby reducing the very resource essential to the Innu's subsistance hunting lifestyle. The data developed by the study team specialists (Knight, 1986) showed that recreational hunting and trapping would not be large enough to outway the benefits of providing better access to more hunting and trapping territory for the traditional hunters, the Innu. In the long run, "stocks should not be adversly affected" (Knight, 1986).

vii) Historic Resources

No concerns were expressed either by the public or by government agencies concerning the loss of historic resources as a direct consequence of the tote road. The survey (Penny, 1986) of the roadway corridor suggested that only potentially minor sights, such as temporary encampments and river crossing points, would be affected by the road development.

In summary, the major concern expressed by the public dealt with the further reduction in native resource use leading to a negative economic as well as socio-cultural impact. Most comments by the public reflected the concern that the project was not moving forward fast enough and that, in the long run, the undertaking was a positive development.

4.2.3 Financial Evaluation of Design Alternatives

A financial comparison of the Net Present Value (NPV) of the proposed and alternative routes has been undertaken comparing the direct monetary costs and benefits of the options. The analysis represents an updating of the preliminary comparison of the alternatives presented in the Newfoundland Highways Prospective Analysis (ADI, 1984) with a revised alternative route and refined cost estimates.

The primary benefits of the proposed project are of a social and economic development nature. They relate to the social benefits of de-isolation of the Wabush/Labrador City area and the long term economic development benefits of a Trans-Labrador highway of which the proposed road section is one link. These benefits have been quantified in dollar terms in a general way in previous studies; however, it is difficult to quantify the differences between the two designs with respect to these primary benefits. The key factors in achieving these benefits, however, relate to travel times and convenience of travelling between Labrador City/Wabush and Churchill Falls. While difficult to quantify in monetary terms, both of these factors heavily favour the proposed routing option which is 60 km shorter and would save an estimated 50 minutes in travel time over the alternative route which uses the Esker Road. To achieve the primary and long term benefits of the project the proposed option is clearly preferred.

The alternative route was developed in an attempt to identify a lower cost option through the utilization of the existing Esker Road. The alternative route in the new construction section requires more bridges and structures than the proposed route on a per kilometer basis and is therefore expected to be more costly to construct per kilometer. In addition, the existing Esker Road will require substantial upgrading to match the design standard of the new road sections.

A financial comparison of the two options has been prepared based on the assumptions shown in Table 4.2.2.1. The Net Present Value of the future capital and operation costs over the expected seven year construction period and 20 years of road operations have been discounted back to the first year of construction. All costs were in constant 1985 dollars and a "real" discount rate of 10% over and above inflation was used. With a design speed of 80 km/h and grades of 6% to 8% on a gravel road in summer and given the expected high proportion of trucks expected to use the road an estimated average travel speed of 70 km/h was assumed. This resulted in a travel time of approximately 50 minutes longer for the alternative than the proposed option.

The cost estimates for construction and road maintenance have been based on recent experience with this type of road in Labrador. They reflect average costs for DOT District 4 which includes Labrador. As the road is to be open in the summer only, the maintenance cost reflected summer services only. It was assumed that on the Esker Road, there would be no added cost for road maintenance as current maintenance costs are borne by the Churchill Falls and Labrador Corp. If, as part of the project, the Esker Road is assumed by the Province, maintenance costs may be incurred by the Provincial Department of Transportation. In a comparison of the alternatives, however, it is expected that there would be little or no net increase in maintenance costs on the Esker Road if the alternative route was constructed.

Table 4.2.2.1 Assumptions used in the financial comparison and generation of net present value.

Financial Assumptions

- Net Present Value of future costs in constant dollar 1985
- Time horizon: 7 year construction period and 20 years of operation
- All future costs discounted at 10% back to the first year of construction

Description	Options Proposed	 Alternate
• Length - new	130 Km	90 Km
- upgraded	-	100 Km
• Average travel speed	70 km/h	70 km/h
• Average travel time	1.9 hrs	2.7 hrs
Cost Assumptions		
1. Construction costs per km - includes 21% Engineering and contingency	$636,000	$423,000
2. Upgrade costs for Esker Road per km	-	$121,000
3. Annual maintenance costs per km - new road sections, summer only	$ 6,300	$ 6,300
4. Road user Costs		
- average vehicle operating cost per km	$ .29	$ .29
- average value of travel time per hour	$ 12.41	$ 12.41

The estimated road user costs were based on the assumed traffic composition and travel time and vehicle operating costs utilized by ADI (1984). They reflect an assumed split of 50% autos, 40% single unit trucks and 10% transport trucks on the road. The analysis was undertaken assuming two levels of traffic volume using the road; 50 vehicles per day and 100 vehicles per day for 130 days per year (summer only)

Table 4.2.2.2 provides a summary of the net present value of the two routing options. The added road user costs of the alternative routing with 50 vehicles per day and 100 vehicles per day using the road are included.

Table 4.2.2.2 - Net present value costs for alternative Tote Road alignments. Numbers in 1985 constant dollars (millions).

	Alignments		
	Proposed	Alternative	
		@ 50 vehicles/day	@100 vehicles/day
Factors	-	5600 hrs/yr	11,200 hrs/yr
Construction Costs	35.88	39.57	39.57
Maintenance Costs	3.58	3.09	3.09
Added Road User Costs	-	.78	1.57
Total Net Present Value	39.46	$ 43.44	$ 44.23

The proposed routing is expected to be $4M to $5M less expensive than the alternative route and will be more attractive as more people utilize the road. As the basic difference between the alternatives is in the upfront construction costs, this conclusion will not be reflected in the discount rate used in the analysis.

Deferral of the upgrading of the Esker Road would make the alternative option more attractive, however, it would have to be deferred 20 years before the alternative routing would break even with the proposed routing costs. During this period, road user costs and travel time would be increased which would tend to discourage use of the facility.

The proposed routing is less expensive from a financial point-of-view and, as noted above, is also preferred in the achievement of the social and longer term economic development benefits of the project.

4.2.4 The Preferred Alignment

a) Results of Matrix Analysis:

Senior study team members weighed all components, including the engineering considerations as a percentage of 100. The results were as follows:

	Relative Importance (%)
Aquatic Resources	9 ± 3.3
Wildlife Resources	16 ± 2.3
Vegetation/Soils/Geology	5 ± 3.2
Socio-Economics	18 ± 8.8
Tourism-Recreation	8 ± 2.2
Native Resource Use	18 ± 10.4
Historic Resources*	7 ± 8.5
Engineering	19 + 9.5
	100

This initial weighting showed that no single component dominated, suggesting an implicit linkage among the components in that, for example, the Native Resources and Wildlife components are linked through the dependence of the Innu on wildlife resources. Both components are in turn closely linked to the socio-economic well being of the area.

The indicators within each component were also given relative weights (see Table 4.2.3) to yield a significance among variables.

With exception of the Wildlife and Native Resource Use components, the matrix analysis revealed that the proposed route had overall, fewer negative effects than the alternative. Based on this evaluation, which is supported by the component study results, the proposed alignment was chosen as the preferred design.

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*a single value of 25% significantly skewed this average; without it this component average would only be 3.6%.

Table 4.2.3 - Summary of data matrix for two tote road alignment alternatives; summer only scenario. Derived from an evaluation by component specialists, 1986.

	Units	Weight %	Proposed Route	Alternate Route
AQUATIC RESOURCES				
No. of Water Crossings	No.	10	27	17
No. of exceptional salmonid streams	No.	20	4	4
Amount of sensitive fish habitat vulnerable to direct impact	$100m^2$	30	120	550
No. rivers with possible significant salmonid migration	No.	35	5	6
No. of potential commercial fish sites	No.	5	1	0
WILDLIFE				
Significant caribou habitat affected	m^2	20	more	less
Caribou habitat lost	m^2	25	same	same
No. of caribou directly affected	No.	20	more	less
Potential illegal caribou kill	No.	20	more	less
Waterfowl habitat access		15	increased	no change
VEGETATION/SOILS/GEOLOGY				
Merchantable timber production		10	None	None
No. Vegetation communities lost	No.	30	none	none
No. of mined sites (borrow areas)	No.	60	4	2(new section)
Rehabilitation potential			same	same
NATIVE RESOURCE USE				
Native resource harvest loss		20	minor	minor
New and competing land uses		40	more	fewer
Socio cultural degradation as function of hunting reduction		40	greater	less

Table 4.2.3 - continued

	Units	Weight %	Summer Only	
			Proposed Route	Alternate Route
SOCIO-ECONOMIC				
No. of local hires	No.	15	240	260
Average trip time Lab City Churchill	km	20	3.4	4.2
Trucking costs Lab City-Churchill Falls	$/ton	25	66.	80.
New business opportunities		15	few	few
Proximity of Road to Users		10	better	poorer
Likelyhood of loss of access		15	maybe	not likely
TOURISM, RECREATION & RESOURCE USE				
No. of tourists (trip-days)		25	same	same
No. of new cabins		20	many	few
Growth in tourism-recreation opportunities (access-aesthetics)		25	higher	less
Change in users share of resource (native versus non-native)		30	same	same
ENGINEERING				
Construction Cost		20	slightly more	slightly less
Maintenance Cost		15	less	more
Future Use (traffic)		45	much better	less
Safety		20	better	poorer
HISTORIC RESOURCES				
No. sites distributed		45	1	0
No. likely significant sites there		55	same	same

The significant negative effects hinge in large measure on an appropriate mitigation and monitoring procedure including access controls and construction guidelines (see Chapters 5 and 6).

5. SELECTED DESIGN

In the following section we have predicted the impact of the roadway on the existing natural and social environment which was described in Chapter 3 of this report. Both positive and negative impacts are discussed in terms of varying temporal scenarios.

5.1 Description of the Selected Design Alternatives

5.1.1 Plan and Profile

The plan of the proposed route is shown in Appendix C. The horizontal and vertical alignment will be designed to a Rural, Collector Undivided, 80 km/h (RCU80) standard (RTAC, 1976). Table 5.1.1.1 lists the standards for the proposed route.

Table 5.1.1.1 - Road Standards

Design Speed	80 km/hr	
Maximum Gradient	5% 8%	rolling topography mountainous topography
Maximum gradient for drainage	0.5%	
Minimum Radius of Curve	230 m	
Maximum Superelevations	0.08 m/m	
Stopping sight distance	140 m 150 m	minimum desirable
Minimum Passing Sight Distance	560 m	

The horizontal alignment is a combination of circular curves, tangents and transition spirals. The rate of superelevation will be based upon the actual radius of the circular curves. The radius of curves should always be greater than the minimum radius wherever possible and the recommended minimum length for curves is 500 m. Horizontal stopping sight distance will be provided over the entire length of the route and the horizontal sight distance for passing will be provided as frequently as possible.

The vertical alignment is a combination of vertical curves, both crest and sag, and tangent sections of a particular slope. Gradients will be selected which are below the maximum recommended. On gradients of 3% or less, the operation of cars is affected to only a very small degree and truck operation is affected only in very long grades. On a 5% gradient, passenger cars generally have no difficulty operating but trucks may have considerable difficulty when the roadway is icy. Maintenance and operating costs increase with steeper gradients.

The desirable stopping sight distance will be provided for all crest curves. For reasons of safety, it is important to provide as many passing opportunities as possible on the road. The minimum passing sight distance will be provided as frequently as possible.

The relationship of the horizontal and vertical alignments will be considered. The following principle will be used as a guide during the design of the road.

- curvation and grades should be in balance with the terrain and area crossed
- superimposing of vertical upon horizontal curvation will generally provide improved appearances
- short vertical curves should be avoided and the midpoint of horizontal and vertical curves should be coincident
- the need for providing adequate safe passing opportunities should be examined carefully.

The horizontal and vertical alignment are the most permanent features of the road and once constructed will be the most difficult to modify.

5.1.2 Cross Sections

The typical cross sections for the proposed route are shown in Exhibits 5.1.2.1 and 5.1.2.2. The road will be constructed primarily with fill or a combination of fill and earth cut.

The fill cross sections will consist of a minimum depth of fill of 500 mm and a width of 9.0 m. This cross section will be used where the existing ground cross slope does not exceed 10%. The fill side slopes will be determined by the soil type used for fill. Fill side slopes for marginal and glacio-fluvial borrow materials should not be steeper than 2.0 horizontal to 1.0 vertical unless indicated by actual testing. Drainage of surface runoff along the right of way will be handled by ditches excavated parallel to the toe of the fill slope.

The earth cut and fill cross section will be used where the existing ground cross slope exceeds 10%. The cut and embankment side slope should not exceed 2 horizontal to 1 vertical except as indicated by actual testing. The fill material will be supplemented with a 500 mm thick by 6.0 m wide granular during surface in areas where the subgrade strength is not adequate.

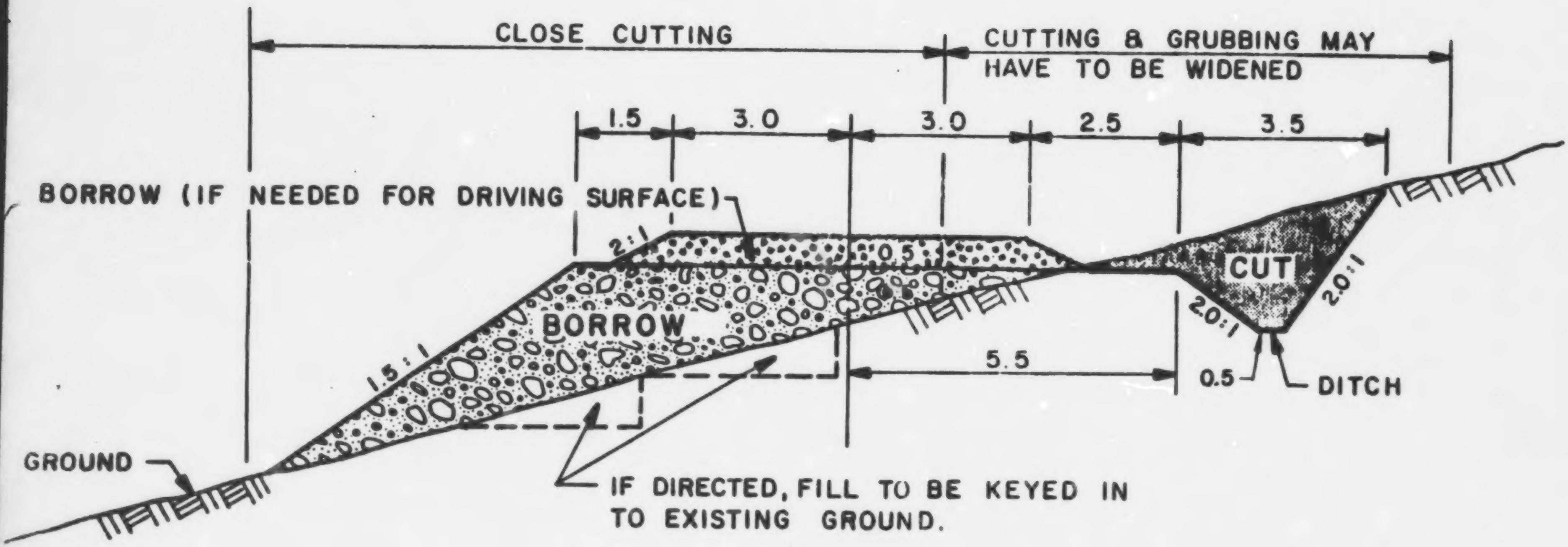
Excavated material will be tested and if suitable will be used to replace some of the needed fill material.

5.1.3 Right of Way Requirements

The road right of way will be 40 m wide.

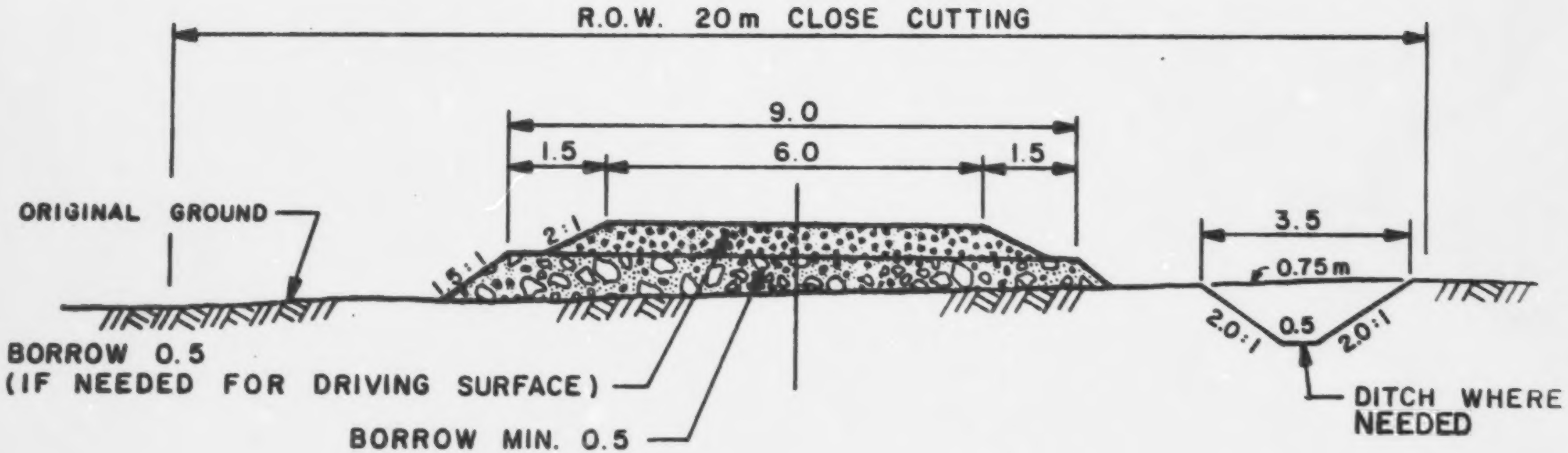
5.1.4 Staging

The elements affecting staging were discussed in Section 4.2.1.


CLOSE CUTTING
CUTTING & GRUBBING MAY HAVE TO BE WIDENED
1.5
3.0
3.0
2.5
3.5
BORROW (IF NEEDED FOR DRIVING SURFACE)
2:1
0.5:1
CUT
2.0:1
2.0:1
BORROW
1.5:1
5.5
0.5
DITCH
GROUND
IF DIRECTED, FILL TO BE KEYED IN TO EXISTING GROUND.

EARTH CUT AND FILL CROSS SECTION
FOR LABRADOR TOTE ROAD

FIGURE 5.1.2.1


R.O.W. 20m CLOSE CUTTING
9.0
1.5
6.0
1.5
ORIGINAL GROUND
2:1
1.5:1
3.5
0.75m
2.0:1
0.5
2.0:1
BORROW 0.5
(IF NEEDED FOR DRIVING SURFACE)
BORROW MIN. 0.5
DITCH WHERE NEEDED

FILL CROSS SECTION
FOR LABRADOR TOTE ROAD

FIGURE 5.1.2.2

5.1.5 Operation of Road

The Tote Road will be constructed for summer only use. Design criteria permitting future roadway upgrading with only a minimum of change to the basic horizontal and vertical alignment will be applied.

5.2 Impact Details

5.2.1 Nature of Environment

5.2.1.1 Aquatic Resources:

Impacts on fish resources resulting from the Tote Road fall into two categories:

- short term construction impact; and
- long term effects such as faulty culvert construction, stream blockages, etc.

a) Short-term Construction Effects

Impact from construction related activity would be caused by (LGL, 1986);

- siltation and sedimentation of fish habitat during construction
- gravel excavation for construction use
- contaminated stormwater runoff from construction camps and material storage area and/or solid waste and sanitary sewage
- fuels, lubricants and other chemicals required continually throughout the construction period could be spilled, improperly disposed of or improperly stored, leading to watershed contamination
- blasting may be required at river crossings to prepare for the foundations of structures. This activity could cause slope destabilization leading to stream blockages such as velocity barriers or physical obstructions.

b) Long Term Effects

Essentially three long term impacts are possible:

- chronic siltation due to improper slope stabilization and rehabilitation of construction sites

- overfishing at new access points to river crossings leading to permanent fish stock loss
- improper culvert placement; improper sizing leading to high cross sectional velocity, long in-culvert "runs" without resting areas for fish and downstream scouring leading to impassible plunge pools.

We suggest that without the proper safeguards and appropriate monitoring, all of these effects are probable and in fact quite likely given the generally poor environmental awareness of construction crews. Site-specific concerns were presented in LGL's (1986) component report and will be referenced to establish the specific sensitive features at each crossing.

5.2.1.2 Wildlife:

Caribou

The potential impact on wildlife is closely tied to the number of (new) resource users. The improved/new roadway would provide easy access to the herd and could result in an increase in illegal hunting. During construction impact could be significantly higher than at other times due to the concentration of workers at man-camps. Two and ten years post construction would see little change in the impact unless steady unchecked hunting (it is now illegal) were permitted in which case the Lac Joseph caribou stock could be depleted beyond recovery.

The more use the roadway receives, i.e., all season road, or linkage to the national highway system, the higher the likelihood of damage to the population as a result of:

- human access and disturbance;
- illegal hunting;
- habitat removal;
- road kills.

Other Wildlife

Generally, other wildlife, including small mammals, waterfowl and moose, would be similarly affected in that improved access would bring more recreational use and hunting (legal and illegal) and a higher game harvest. It is conceivable that local wildlife populations could be seriously stressed by the rapid influx of hunters.

The preferred alignment will traverse a portion of the Ossakmanuin Lake known as an excellent Canada goose habitat (personal communication, Boles, 1985; CWS, 1985). There is some concern that the Canada goose may be heavily harvested once easy road access to this area is available. The impact of this hunting pressure has not been assessed.

5.2.1.3 Vegetation/Soils/Geology:

Improper rehabilitation of construction areas, borrow pits and slopes could lead to serious erosion problems and chronic sediment release to the water courses.

As no rare, unusual or uniquely distributed vegetation communities were found, the impact in terms of species or community diversity should be minor. The removal of ground cover however will be significant.

Soils left succeptible to runoff leaching and erosion could release nutrients until they become very infertile and a poor medium for vegetation regeneration. Therefore, rapid revegetation is desirable not only for erosion control but also for maintenance of nutrient rich soils which respond well to revegetation schemes.

5.2.2 Human (Social) Environment Impacts

5.2.2.1 Socio Economic Impact:

a) During Construction

During construction, the impacts fall upon local business, the labour force, the work camp sites and on the wildlife potential of the area for hunting, fishing and tourism.

During construction, labour requirements for construction of the proposed Tote Road are as follows:

Each construction contract would require about 30 people and an additional 10 for each bridge. Over the 7-year construction period, 105-140 person years of employment will be created.

Consultation with Canada Employment and Immigration Commission concerning their labour market information indicates that there are sufficient numbers of truck drivers and heavy equipment operators on U.I. claim in Labrador to form an ample labour pool for this project.

The estimate of direct and indirect employment generated by construction activities in Newfoundland and Labrador is such that an additional 1.058 jobs would be created through successive rounds of spending. Using the Provincial multiplier, direct employment at 30 to 40 persons per contract on the proposed route implies that an additional 31 to 42 jobs will be created in the Province. In short, the actual creation of the jobs is positive by not putting pressure on the labour force skills which are available in Labrador. It creates from 30 to 40 jobs per contract. The multiplier effect produces an additional 31 to 42 jobs per contract. The effect on the local economy will be much stronger if local hiring takes place.

i) Impact on Business

Labour income multipliers indicate the total direct and indirect income generated in the Province per dollar of direct income. For the construction industry as a whole, this is estimated to be 1.897, i.e., for every dollar of direct income an additional 90¢ of income is generated through the multiplier effect.

A.D.I. (1984) indicated approximately 27% of the value of the construction cost on the highway would be spent on project construction wages. Applying 27% to the $50 million cost estimate for the proposed route yields wages and salaries of $13,500,000. Using a construction multiplier of 1.9 this expenditure could have the effect of adding $25,650,000 to the Provincial economy. Knight (1986) indicates that it is unlikely that this will be achieved in the study area itself due to the potential for leakage from the local economy.

ii) Work Camp Impacts

Three work camps will be required during the construction of the proposed road. One will be near Ross Bay Junction, the other will be in the vicinity of Twin Falls while the third will be at 110 km. The site at Ross Bay Junction is in an already developed area, while the camps at 110 km and near Twin Falls will be in generally undeveloped areas. The work camps would be small and temporary leaving no lasting visual impacts as the work camp buildings would be removed upon completion of construction. The location of a work camp in a previously undeveloped area has the potential to damage the immediate vicinity of the camp through clear cutting and the creation of spaces for lay down and vehicle parking.

Peoples perception of work camps includes ideas that they cause increased crime and violence in the area. However, due to the small size of the work camps and the proximity of the work camps to the permanent communities, these effects are considered highly unlikely. Furthermore, most employees would probably be able to go home for the weekends.

Knight (1986) suggested that the work camp may put additional requirements for supplies on the CFL Co. operation in Churchill Falls. This could be mitigated quite easily through advanced communication of the work camp needs.

iii) Vandalism at CFL Co. Control Structures and Facilities

CFL Co. have indicated their concern that increased accessibility on the proposed route may increase the incidents of vandalism or damage to their control structures or the Twin Falls generating station, which is at present mothballed.

b) Two Years Post Construction Impacts

Knight (1986) concluded that the impacts associated with a seasonal Tote Road will be social and psychological rather than economic. They suggest that positive impact will outweigh negative ones and that the majority of Labrador residents are in favour of this transportation improvement. People's perception of the project is focused on the longer term rather than on the seasonal Tote Road, i.e., impacts and benefits are perceived as stemming from the Quebec Trans-Labrador Highway rather than the intermediate step of creating a road link between Churchill Falls and Ross Bay Junction.

i) Impacts on Isolation/Travel

One of the most important effects of developing the seasonal Tote Road will be its psychological effect of increasing people's mobility and reducing the sense of isolation that has been felt in the area. People's propensity to travel will increase. This will provide for more frequent interaction between Churchill Falls and the Labrador West

Communities. Even considering the quality of the Freedom Road, the interaction between Labrador West and Upper Lake Melville will undoubtedly increase.

ii) Displacement

Lobstick Lodge's owner perceives that the development of the proposed route will put him out of business. The Lodge is a combination of a fishing lodge with a motel, restaurant, etc., located on the Esker Road. It operates on a seasonal basis and has benefitted from the 200 or so trips in both directions as people travel from Labrador West via the railway to connect with the ferry in Goose Bay. It is not anticipated that he would lose his sport fishing clientele.

iii) Accessibility Changes for Cabin Owners on Esker Road

Under the conditions of a seasonal Tote Road there is no change in accessibility to the cabins as CFL Co. will continue to use the railway, and the Esker siding as their railhead on a year round basis. Under the condition of an all-weather operation, CFL Co. will do summer maintenance on the road between their control structure at Gabbro and Churchill Falls.

iv) Innu Related Impacts

The number of jobs and development opportunities resulting from a seasonal Tote Road is considered small. People's perceptions, however, are different in that the road will "open up" Labrador, create a large increase in development opportunities and related employment. This may be the situation over the longrun, however, it is not a direct result of the Tote Road.

The Innu perceive the road will bring a vast increase in the number of Non-Innu competing for natural resources. They perceive that this will result in a depletion of the traditional resource base. The seasonal Tote Road along the proposed route will improve access to resources for Innu and Non-Innu alike. It is considered that the resource base in general is large enough to withstand pressure at this stage. There is potential for an increase in the number of cabins in the Tote Road area. These will not be permitted to locate in an adhoc manner as the Lands Division of the Department of Forest Resources and Lands has policies with respect to location and development of cabin lots. This concern is further addressed in Chapter 6 and 7 of this report.

c) Ten Years Post Construction Impacts

i) Knight (1986) has concluded that according to current plans, the Baie Comeau to Mount Wright road link seems certain to be completed before an all weather link across Labrador and probably before the seasonal Tote Road is completed. It is in this context that the 10 year post construction impact predictions are made.

In terms of people movement, the distance between Baie Comeau and Happy Valley, Goose Bay, approximately 1,030 km via the proposed route, would be a limiting factor for travel across Labrador. However, given the high level of interest expressed by Labradorians in the development of the road a higher level of use for intra-Labrador travel can be expected. They have identified tourism opportunities for highway related business such as that proposed at Cache River on the Churchill River Road and at Lac Grand Hermine on the Ross Bay Junction Road, as well as additional opportunities in the Lake or Poisson River areas. All these changes are seen as being positive aspects of the road development.

ii) Freight Movement

In terms of freight movement, it is quite clear that transportation by the Tote Road would replace the extremely expensive air freight mode particularly during the winter months under the all weather road scenario. In 1982, just under 2,300 tons of general cargo was handled through Wabush/Churchill Falls and Goose Bay Airports. It is assumed that a large percentage of this would have been trucked over an all weather Tote Road. Savings in the neighbourhood of $800 per tonne can be expected as the difference between the air freight mode versus trucking or a rail operation. Knight (1986) has concluded that the single greatest factor affecting the cost of freight moved into the area is the Federal Government subsidy applied to CN Marine. As there are no plans at present to change the CN Marine subsidy, therefore, it will remain in effect as long as Labrador remains an economically depressed region. While trucking will not replace CN Marine on a cost basis (as long as the weather road is heavily subsidized) it would be a competitor with an all weather road in terms of providing a year round reliable supply of goods and possibly in terms of the quality of goods delivered. It will also mean less storage inventory costs to the business community. The extent to which this will result in transfer from marine to road transport will depend upon many factors particularly a decrease in the CN Marine subsidy and an all weather road of high geometric standard between Happy Valley, Goose Bay and Baie Comeau. Under this condition, it is assumed that a large percentage of freight would be trucked into the study area.

d) Conclusion

i) Knight (1986) evaluated the significance of all the socio-economic impacts and concluded that there were no major negative impacts associated with either route scenario. They have reached this conclusion based on the fact that CFL Co. would maintain the Esker Road at least as far as Gabbro and, as long as the Tote Road is a seasonal operation, they will carry out winter snow clearing as at present.

ii) Year-Round Maintained Road Impacts

The impact of the construction of a year-round road on Innu harvesting would be greater than that of the summer only road. The maintenance of a year round road would result in a more rapid increase in the use of the area by the residents of Wabush, Labrador City and Churchill Falls during the winter months. At least 66 part time trappers based in Wabush and Labrador City are now operating in what are perceived to be crowded conditions. At least another 31 part time trappers are resident of Churchill Falls utilizing land along the Esker Road. Significant numbers of trappers from Wabush and Labrador City as well as some trappers from Churchill Falls would likely shift to the new road once winter maintenance commences. Winter recreational vehicle users would also begin to use the area giving easier winter access. Since most of them have a regular income, and can afford to own trucks, all terrain vehicles and other equipment which most Innu hunters do not have, the latter would not be able to compete in gaining access to the best trapping areas made accessible by the road.

Innu cultural patterns of land use do not favour mechanized trapping as used by Non Innu. One reason for this is that Innu prefer to combine trapping with subsistence hunting. Innu hunters/trappers would thus probably benefit little from the access provided by year round road. For those that did use the area as a result of the road or who camped in the bush further away from the road would find that he had relatively fewer animals to hunt than they would have had without the road. Competition from Non-Innu trappers and recreational users would constitute a significant negative impact as far as Innu harvesting is concerned.

Mitigation measures will be needed if the proposed road is not in the long run to have major negative effects on present levels of Innu harvesting in the area, and if it is not to interfere with the process of return to normal levels of harvesting by the Innu.

5.2.2.2 Impact on Native Resource

a) During Construction

Tanner and Armitage (1986) have assessed the degree of impact on the Native Resource Harvest. They concluded that harvesting impact will be minor as only a small number of workers will be involved and they will be active when Innu harvesting activities are at their lowest level. The work camps will be limited to 30 workers and it is not anticipated that they will engage to any great extent in any hunting or fishing. The only caveat put on this judgement is with respect to secondary impacts resulting from road construction activity. The creation of an extensive network of access roads for hauling fill would result in the loss of significant amount of wildlife habitat. This in turn might have a moderate or major negative impact in the short term on Innu harvesting in the areas on either side of the road.

b) Post Construction Impact

i) Summer Road Only

With the development of the proposed route increased resource usage among Innu and Non-Innu people is forecast. While the Innu themselves would be drawn into the area, their pattern of land use would be minimally affected. The expansion of Non-Innu into the area of the Tote Road is difficult to predict with precision, but there is every reason to believe it would be quite rapid. Residents of Wabush and Labrador City have already begun to expand their recreational land use into the area of the new Road between Wabush and Ross Bay Junction (during the first summer after the road was completed). From the Innu perspective, the fear is that in the immediate post-construction periods cabins would be built, and sports hunting, fishing and other recreational activities using snowmobiles and all-terrain-vehicles would begin in the area. The extent of these activities would increase over time. However, under this scenario these impacts would be limited due to the limited size of the population, which would use the area, (Wabush, Labrador City and Churchill Falls, and to some extent Happy Valley, and Goose Bay). At this point, little or no construction of service stations, motels, rest stops, picnic sites or parks would likely occur. Since the road would not be open in winter, Innu hunting and trapping would not be facilitated by the road. However, the general area, particularly close to the road would have the wildlife population disturbed by recreational users. In winter, the unploughed route would be used by snowmobilers at either end.

ii) Year-Round Continental Road Connection

The long term impact of the year round road connected to the rest of North America would include at least some of the following:

Increased traffic, particularly tourist traffic would likely be concentrated at scenic areas where restaurant stops, motels and other facilities could be located on the proposed route. This could include the area near the Poission and Ashuanapi Rivers and the Ossakmonuan Reservoir.

There would be construction of new cabins along the route by Non-Innu residents of Labrador. There would be the construction of sport fishing lodges. A potential site is near Ossakmanuan Reservoir. There could be an increased number of trap lines operated by Non-Innu in the vicinity of the road. It is possible that subsidiary roads, providing greater access to a wider corridor on either side of the road would be built.

The long term impact of the year round road connected to the rest of North America would be major (Knight, 1986; Tanner & Armitage, 1986). As land in several parts of the interior of Labrador and Quebec already has been taken for road construction, military training, resource developments and recreational and trapping use, the proposed route will pass through one of the few large areas where Innu can engage, largely unhindered, in their activities which have special cultural significance. Innu cultural beliefs and values are intricately linked to harvesting activities, therefore, any significant losses with respect to hunting and gathering would mean an almost equal socio-cultural hardship.

We propose a series of mitigation measures (see Chapter 6) which should allow for a sound land use planning in the newly accessible (by non-Innu) lands.

5.2.2.4 Tourism, Recreation and Use of Natural Resources

a) During Construction

Impacts

There are no short or long term impacts on the study area relevant to the tourism and recreation analysis (Knight, 1986).

b) Post Construction

i) Tourism Related Impacts

The construction of the Tote Road will have a minimal effect on the tourist related travel to Labrador. Even with the highway, it is unrealistic to expect any appreciable increase in the number of non-residents travelling to Labrador for vacation purposes. Most visitors fly in to camps to enjoy sport hunting and fishing. Therefore, the highway is not required for transportation of these tourists.

The largest impact on the resources would be a rise in the tourist volume travelling along the proposed route. However, without a major marketing scheme, this increase would not be realized (Knight, 1986).

ii) Recreation Related Impacts

Development of the highway will allow for increased accessibility to the study area. This could prove attractive to people who wish to have a cabin in the "wilderness". An increase in cabin development will lead to more recreational sport fishing. As well the road will open the area to more hunters and trappers.

With a year-round maintained road or a continental road link, the recreational use of the area would grow incrementally and continue to put an ever increasing pressure on the natural resources, i.e., aquatic and terrestrial wildlife and recreational services such as public parks. Although neither the aquatic nor the wildlife resources (except caribou and moose (see St. Martin & Theberge, 1986)) would be seriously stressed, the increased use of the resource by non-Innus, in an area that for centuries has been Innu territory would restrict the traditional Innu, land use pattern leading to conflict and significant socio-cultural impact in the region.

iii) Visual Intrusion

Without proper road design considerations, the visual and aesthetic impact of the road on the landscape could be severe. The most common condition would be:

- exessive vegetation removal
- unnecessary road cuts
- large unsightly borrow areas - not reclaimed
- unsanitary construction camps - litter
- improper construction materials storage and disposal

The larger or more extensive the work, e.g., a year-round road or a "continental-link" road, the more likely that this impact will be present and will require specific mitigation measures.

c) Summary

The impact of the road on the tourism recreation resources per se would be minimal, however, the changes in land use, namely, the distribution between Innu and non-Innu could have serious long term effects. The study area has, for centuries, been the hunting and gathering ground for the Innu and without the proper safeguards, this area could be permanently inaccessible to them.

5.2.2.3 Historic Resources:

The biggest concerns during the construction phase of the highway is the direct destruction of palaeontological or prehistoric sites. These sites are difficult to distinguish because of their lack of visible evidence (unlike historic sites). However, it is highly unlikely that any prehistoric sites will be found during construction, as none were found during the surveys conducted for the Environmental Impact Assessment (Penny, 1986).

This level of effect would not change appreciably with different road scenarios given the history of the area, the geological conditions and the fact that no significant prehistoric or historic sites were found during the field survey in 1985 (Penny, 1986).

6. MITIGATION MEASURES

The proposed road construction project will result in a number of impacts for which certain mitigative measures are appropriate.

6.1 Development of a Resource Management Plan

Accessibility effects resulting from the Tote Road construction would be most strongly felt with respect to:

- socio-economic considerations
- aquatic resource use
- wildlife resource use
- resource use distribution among native and non-native users and
- tourism recreation potential

As these issues cannot be dealt with in isolation, we recommend that the Department of Forest Resources and Lands (responsible for planning, management and development of crown lands), consult with various federal and provincial resource managers and users (of the road and study area) and prepare a comprehensive resource management and land use plan. Key components of such a plan would be:

- the need to protect the Lac Joseph caribou herd
- protection of aquatic resources, i.e., prevention of excessive harvesting and water pollution from wastes
- the need for access by Innu to the study areas for hunting, fishing and trapping activities
- the need for an equitable distribution of the available natural resources, e.g., game and fish, based on need and historical use
- woodland management within the road corridor
- the development of cabins

- tourist operations
- recreation and service facilities

These areas of concern are the ongoing responsibility of both federal and provincial agencies principally:

- Department of Forest Resources and Lands (Prov.)
- Department of Culture, Recreation and Youth (Prov.)
- Department of Environment includes DFO (Prov. and Fed.)
- Department of Indian Affairs and Northern Development (Fed.)
- Department of Development (Prov.)
- Department of Municipal Affairs (Prov.)
- Department of Transportation (Prov.)

The Department of Forest Resources and Lands, with the close cooperation of all other agencies involved, would develop such a plan within the 7-year construction period prior to the road becoming an all season operation or before the effects of linking Labrador West to central Canada become a reality. In the absence of any major problems, such a plan could be ready for implementation in 2 to 3 years (from commencement of construction) or sooner.

During the development of the plan, DOT will recommend to the Department of Forest Resources and Lands that the road be designated a "Protected Road" under the statutes jointly administered by the Department of Municipal Affairs and the Department of Forest Resources and Lands.

Furthermore, if propriatary leases or building permits are to be issued, DOT recommends that the managers of the fish and wildlife resources be particularly vigilant in their protection of the resources and that the group involved in developing the management plan be consulted before any approvals are given. The intent here would be to assure that the objectives of the management plan are not diluted by inappropriate permits and approvals. We recommend that these controls cover the entire study area as shown on Figure 1.2.2. It is suggested that Innu and "settlers" be formally asked to participate in the planning and development of the plan. The participation of the "public" should not be "reactive" but "participatory". With the benefit of the 7 component studies, we further suggest that the public involvement include not only "settlers" and Innu but business and municipal representatives. DOT will make available, as required, all data gathered for this EA, in order to provide the background on the local socio-economic conditions.

6.2 Engineering Considerations

6.2.1 Construction Staging

Construction of 130 km of road and 3 major bridges requires detailed consideration of its staging. All work can be undertaken most economically during the ice free period from June until September. Instream activities are limited to the least critical time period for fish (June 15 to September 1). Further restrictions on construction work occur during the calving period for caribou, from late May through June. With these limitations, the maximum construction period, for the road is four (4) months, generally from July until October. In such a restricted time frame, the early mobilization of equipment and material is essential to fully utilize the limited construction period.

The contract sizes recommended (see Table 4.3.1.1) vary from 14 to 25 km in length and from $4.3 M to $7.5 M in value, including bridge and structure construction. The size of construction contracts reflects the shortness of the Labrador construction season and an effort to optimize the utilization of the Labrador labour force. Contractors will be required to give preference to locally available trades. The construction staging spreads the construction over a period of 7 years with approximately 40 persons per year employed in construction.

Table 4.3.1.1

Construction Year	Road Construction (km)	Bridges & Structure Cost (contracts)	Construction Value ($M)
1	24	1	7.2
2	18	1	5.4
3	14	1	4.3
4	14	0	4.3
5	15	0	4.3
6	21	1	6.3
7	25	0	7.5
TOTALS	131	4	39.3

The proposed staging will allow extensive use of local labour, thus benefitting the local economy. Effects on the natural environment will be minimized by utilizing the recommended construction season.

6.2.2 Buffer Zones

The extent to which the natural environment can be disturbed by the construction process must be limited.

Aquatic habitat protection will require the provision of a buffer zone of undisturbed vegetation between the road right of way and all waterbodies. The buffer zone will filter sediment from runoff water and minimize sedimentation. Construction activities within stream crossing sites will be restricted by delaying removal of vegetation until the actual crossing construction is started, prohibiting the use of construction equipment in the active stream, and diverting the water course, where possible, away from the sites of construction activity. Rehabilitation of the disturbed stream banks should be undertaken immediately after installation of the crossing structures.

Wildlife disturbance will be reduced by locating construction camps away from stream crossings, trails and local habitat favoured by wildlife. Hunting of moose, caribou and bear would be prohibited, unless approved and permitted under wildlife regulations. A buffer zone should be maintained around all construction camps within which all hunting activities are restricted.

6.2.3 Construction Camps

Construction camps will provide permanent living accommodations, for up to 6 months of each construction year. Garages for the maintenance, repair and storage of equipment will also be part of the camp site. The camps will be located at approximately 68 km, 110 km and 174 km.

The construction camp sites should meet the following requirements:

- provide 100 m buffer between any water body
- clearing and grubbing of site to be kept to minimum area required
- utilize areas expected to be used for borrow materials
- location to be away from significant wildlife habitat
- should be suitable for the location of a maintainance camp after construction is completed
- disturbed areas to be rehabilitated.

6.2.4 Erosion

The surficial soils along the proposed route falls into 5 categories:

- morainal deposits
- glaciofluvial deposits
- colluvial deposits
- organics
- rock

Morainal and glaciofluvial deposits are generally stable and form about 81 percent of the soils found within the proposed route corridor. The glaciofluvial deposits, about 7% of soil types, will form the main source of construction material for the Tote Road. Side slopes of excavations and embankments in these materials should not be steeper than 2 Horizontal and 1 Vertical.

Colluvial deposits, about 13% of soil types, are generally unstable and where possible road construction should be routed around such sites. These deposits can also be found in stream banks and excavation or disturbance of them should be avoided. Rehabilitation of slopes will be essential to maintain slope stability.

Organics form about 2% of the soil types. While minor in overall extent, organics are sensitive to disturbance and will have to be excavated prior to road construction. Excavated organic materials should be used for rehabilitation of disturbed areas.

Rock is found over 4% of the corridor. Removal of rock for road building is expensive and would be undertaken only when necessary, to stabilize organic and colluvial deposits.

6.2.5 Ossokmanuan Lake

This lake forms part of the Smallwood reservoir for the Upper Churchill Falls and Twin Falls electric power generating facilities. The Twin Falls power plant is not currently in operation and the water is used exclusively by the Upper Churchill Falls power plant. The Tote Road will be constructed across the lake at 157.0 km, 160.5 km and 162.0 km. The crossing at 157.0 km is expected to be made via a causeway and combination bridge and culvert structures.

Information from Churchill Falls (Labrador) Corporation indicates that the structure opening should handle 1,900 m^3/sec representing up to 50% of the flow required for Upper Churchill power generation. If the Twin Falls power plant were to be restarted, flow through the structures would be reversed. The opening would be designed to eliminate any constriction of flow which would impede passage of fish or cause scour of the channel with subsequent siltation. The proposed bridge would likely be three spans with a total length of 120 m to 150 m and a maximum water depth of 11 to 12 m. Adequately-sized culverts would be installed where possible to reduce the size of the bridge.

6.2.6 Borrow/Fill Material

The proposed route will be constructed primarily on fill. The glacio-fluvial soil type (eskers) which forms about 7% of the soil types, within the route corridor, is most likely to provide fill material. These esker deposits were found at 68 km, 110 km, 158 km and 174 km. The deposits will be excavated or borrowed to be used in constructing the road.

Based upon an average fill depth of 0.5 m, a road width of 9.0 m and the total length of 131 km, it is estimated that 600,000 m^3 of fill material will be required.

During detailed design, the road should be routed to provide access to the esker deposits. The horizontal alignment should be positioned to cross the potential fill deposits at right angles to permit recovery of the maximum amount of the fill material

6.3 Natural Environment

6.3.1 Aquatic Resources

i) Fish passage blockage will be prevented through the appropriate design and placement of culverts. At each crossing, the structure will be set in place with reference to the specific guidelines prepared in Table 4

Table 4. Recommended crossing structures for some selected watercourse crossings along the preferred route. For purpose of brevity in this table, the following abbreviations have been used: Arch plate = structural plate arch, Pipe arch = structural plate pipe arch, Culvert = cylindrical or elliptical culvert sunk into streambed.

Stream and km.	Recommended structure	Comments
Km 70.5, unnamed	Arch plate or pipe arches.	Brook trout habitat up and downstream, likely to be spawning migration in this area.
Km 72.0, unnamed	Culvert.	Low fish density in area but probable migration route from pond downstream. Existing beaver dams may obstruct fish migration at some flows.
Km 77.5, unnamed	Arch plate or pipe arches.	Rapids at centerline may create a barrier when stream culverted. Consider moving crossing 30 to 50 m upstream.
Km 82.5, unnamed	Arch plate or pipe arches.	Important salmonid habitat near proposed crossing; also probable migration route.
Km 85.5, Miron R.	Bridge.	Probable fish migration route; steep gradient at the crossing would create a velocity barrier if the stream were constricted.
Km 88.5, unnamed	Culverts.	Probable fish migration at crossing.
Km 102.1, unnamed	Arch plate or pipe arches.	Probable migration route; not examined in detail during field study.
Km 103.0, unnamed	Culvert.	No major fish movements anticipated.
Km 111.5, unnamed	Culvert.	Poor fish habitat; no significant migration likely.
Km 114.0, unnamed	Arch plate or bridge.	Fish migration likely; gradient could obstruct fish movement through culverts.
Km 116.5, unnamed	Arch plate.	Brook trout relatively abundant; high velocities observed; possible obstruction if stream constricted.

Table 4 continued.

Stream and km.	Recommended structure	Comments
Km 122.0, unnamed	Pipe arches or culverts.	Gradient is gentle and velocities are low; migration obstruction unlikely provided sufficient culverts provided.
Km 126.5, unnamed	Arch plates or pipe arches.	Significant fish movement likely but gradient should not cause obstruction provided stream not severely constricted.
Km 138.0, unnamed	Bridge.	Probable fish migration route; steep gradient and high discharge would render fish passage through culverts impossible; large culvert crossing possible if road moved 500 m upstream to Type 4 habitat.
Km 144.0, unnamed	Arch plate or pipe arches.	Small rapids situated at crossing; recommend moving crossing 50 m downstream; if moved, large culverts could be sufficient.
Km 157.0, unnamed	Pipe arch or culverts.	Flooded by reservoir.
Km 179.0, unnamed	Culvert.	Will require channel modification to consolidate flow through bog area; gradient is low, so large sunken culvert should not obstruct fish.
Km 186.0, unnamed	Bridge or arch plate.	If crossing situated in narrows, steep gradient would produce a velocity barrier inside a culvert; if road relocated to cross pool area, large culverts or arch plates may be sufficient.
Km 194.5, Valley R.	Bridges or arch plate.	Two river channels; each requiring a bridge due to steep gradients at present location; if crossing moved, arch plates may be sufficient.

of the Aquatic Component Report (LOL Ltd., 1986) and according to the DOT specifications manual.

ii) During construction at erosion-prone crossings at Miron River (85.5 km) and at the Unnamed River 116.5 km), a geotextile barrier or other standard sediment control mechanism (settling pond) will be installed to prevent sediment runoff into the rivers. These measures will be in accordance with DOT specification 141-1 and 141-2. If unusual erosion conditions are detected at any other sites where drainage is into a significant water (as listed in LGL, 1986) similar preventative measures will be applied. DOT specifications will be followed at all times.

iii) In order to prevent any serious erosion problems, rapid stabilization of base soils will be standard procedure. Where possible, within 5 days of the completion of work in an area which has had the vegetation layer removed, soil stabilization will be initiated by an approved method.

iv) The DOT will request the local fisheries officer to regularly patrol the road to control the fishing activity at newly accessible crossings. If unusually high fish migration "runs" are detected the fisheries officer will be encouraged to post restrictions for those waters. It will be the responsibility of the Department of Fisheries and Oceans to manage this resource.

6.3.2 Wildlife

i) The most serious impact which needs mitigating (in the view of the wildlife research team) is the increased hunting, albeit illegal, of the Lac Joseph caribou herd. It is unrealistic to put in place a comprehensive enforcement program but we do suggest a random monitoring program with severe penalties. DOT proposes to meet with the Wildlife Division and propose a random spot-check program for the road.

ii) Issues with respect to opportunistic poaching during construction and the distruction of habitat during recreational activities will be addressed through design and contractual arrangements as are currently followed by DOT. Roadway construction will be carried out by adhering to environmentally sound engineering practices; minimizing the destruction of wildlife habitat and ensuring that "barrier" effects are minimized. During construction, the project engineer shall ensure that the fire-arms policy in accordance with provincial regulations be maintained and that there be strong discouragement of construction workers using track vehicles during off hours to access off road areas.

6.3.3 Vegetation/Soil/Geology

Mitigation measures are required for clearing and grubbing, borrow areas, bog removal, erosion of fine materials. The need for these activities shall be determined at the design stage and the procedure shall be specified according to the most current specifications for grubbing, grading of fill, grading of cuts, borrow, excavation of muskeg or bog as included in the Department of Transportations' specifications manual (1985). The appropriate specifications shall form part of the construction contract with local contractors.

6.4 Human (Social) Environment

Impacts on the human environment requiring mitigation generally are related to resource use conflicts and changes in accessibility which arise during and after the construction of the seasonal Tote Road between Ross Bay Junction and Churchill Falls. A methodology for mitigating these has been recommended in Section 6.1.2 of this report.

6.4.1 Socio-Economic Components

Impacts and mitigation are dealt with here on a point by point basis.

a) Impact on Labour Market:

No mitigation required.

b) Impact on Business:

No mitigation required.

c) Work Camps:

Communications with CFL Co. will be ongoing to ensure that adequate amounts of provisions are available at Churchill Falls to reflect small increases in demand for supplies. As an alternative, DOT may require the contractor to resupply his own camps. General conduct at the camp with respect to disposal of wastes and the use of the natural resources will be specified by DOT in the contract documents with local contractors.

d) Vandalism to CFL Control Structures and Facilities:

CFL Co. will be advised by DOT to increase level of protection to their structures which have had a history of damage.

e) Change in Travel Patterns on Esker Road:

Under all conditions, Lobstick Lodge will have access maintained at the same level as it has today. This responsibility will be shared jointly by CFL Co. and the Lobstick Lodge owner. If "drive-by" traffic is essential to the continued operation of the interprise motel and restaurant may be relocated by the owner to a planned highway service site. A change in marketing strategy to attract fishing and hunting parties travelling by road would probably be beneficial to the operation.

f) Esker Road Cabin Owners:

No mitigation would be required under all Tote Road scenarios. If CFL Co. moves its rail head from Esker to Ross Bay Junction owners will be advised to negotiate for winter maintenance with CFL Co. (CFL Co. is the owner and operator of the Esker Road).

g) Resource use conflicts between Innu and settlers:

Mitigation as part of the resource management and land use planning program as per Section 6.1 of this report.

h) Resource Harvesting Issues:

Mitigation as part of the resource management and land use planning program as per Section 6.1 of this report. The proposed mechanism has to be focused on the government departments which are responsible for planning and management of lands in Labrador.

6.4.3 Historic Resources

Although no mitigation measures are required, a historic resource identification briefing shall form a part of the initial project meeting for all management and field workers to make them aware of the possible resources within the construction corridor. The reporting requirements of the Historic Resources Act, 1985, communicated to all persons working on construction of the Tote Road and mechanism for reporting artifact finds will be established by the project engineer and the environmental planner for the Department of Transportation.

6.4.4 Tourism and Recreational Use of Natural Resources

Mitigation as part of the resource management and land use planning program will fall within the proposed resource management plan (Section 6.1). Specific mitigation measures which should be considered by the resource managers are the monitoring of water fowl in the study area and relating this to negotiations regarding Newfoundland and Labrador's share of the resource harvest in the North Atlantic flyway.

6.5 Summary

The principal mitigation instrument will be the orderly development and implementation of a resource management and land use plan with participatory input (throughout its development) by the Labrador people (native and non-native) and the various resource agencies. The plan would be prepared within the 7-year road construction period (hopefully much sooner). Other specific mitigation measures concerning the natural and human resources would be implemented when required with the implementations being recorded, for the record, by the DOT project engineer.

During the plan development strict controls over all resource use and land use would be in place through the Department of Forest Resources and Lands.

7. MONITORING REQUIREMENTS

7.1 Environmental Monitoring

On site environmental monitoring is the responsibility of the project engineer supplemented by the assistance and expertise of the Department of Transportations' environmental planner. It shall be the environmental monitors responsibility to enforce the specifications in the contract ensuring the protection of the aquatic and terrestrial environment. It is also DOT's responsibility to ensure the enforcement of resource use commitments.

7.2 Monitoring Strategy

During the detailed project planning stage DOT intends to call a meeting of all affected departments to prepare the implementable monitoring plan using the recommendation in Chapter 6 and 7 of this EIA. The intent of this meeting will be to decide on the division of labour and the implementation methodology. The meeting will be chaired by senior DOT staff.

7.3 Monitoring Specifications

DOT in association with other responsible government departments will be conducting two types of monitoring for this undertaking; i.e., compliance monitoring and effects monitoring.

a) Compliance Monitoring

Compliance monitoring means verifying that the mitigation measures, which were committed to, are implemented properly. The duties for this activity would rest with the DOT Project Engineer and/or environmental planner.

The inspections would be a regular part of the engineer/environmental planner's duties and would consist of a monthly compliance monitoring report submitted to DOT project director. These reports would be available for inspection by DOE.

The compliance monitoring would use the DOT Specification Manua[illegible] (most recent amendments) and the detailed constraint data in the Component final reports as the ultimate authority in establishing non-compliance conditions. Specific monitoring will be carried out in the following areas with reference to DOT specifications:

i) Engineering & Management:

- protection of water courses (DOT Forms 140, 141, 180 and 902),
- clearing grubbing and revegetation controls (DOT Forms 201, 202, 204, 212),
- construction materials storage, preparations and use (DOT Forms 305, 310),
- precipitation runoff controls (DOT Forms 401),
- construction camp conditions, waste handling, conduct & firearms.

ii) Natural Resources:

- DOT intends to meet with the provincial Wildlife Division, DFO, and CWS to assist in developing the most appropriate monitoring program which will control the level of harvest for fish and large game as suggested in the mitigation guidelines. It will be the environmental monitor's duty to provide assistance to the fish and wildlife officer and to record (in the monthly report) the frequency of the fish and wildlife officers visits to the study area. It will be the responsibility of DFO and the Wildlife Divisions to monitor and police the use of this resource. All information stemming from this EIA would be available for use by the other government agencies.

iii) Socio-Economic Considerations:

- As part of the contract administration function, the DOT will require all contractors to comply with equal employment & non-discriminatory employment standards and submit a list of the names and permanent addresses of the 30-40 people hired on for a given contract as well as a list of unsuccessful applicants. These lists would be updated as required by the project engineer. In this way DOT will be able to monitor the employment related mitigation measures agreed to.
- DOT would meet with the regional land use planner and provide a briefing on the construction timing, the construction camp details and the specific concerns regarding the projected future land development in the study area. DOT would be prepared to provide the planner with socio-economic data from the component studies as it relates to the development of relevant land use guidelines to protect all residents affected. These data would then be used in the preparation of the plans as described in section 6.1.

b) Effects Monitoring:

Effects monitoring involves examining whether the impacts occur and if so, if they occur at the predicted magnitude. Effects monitoring provides a measure of the validity of the predictions, and most importantly it is a means of assessing and re-evaluating the mitigation stragegy in terms of whether it is achieving its extended purpose. It is only through effects monitoring that the proponent can determine if the mitigation dollar has been wisely spent and the public will know if the mitigation program adequately mitigated the target impacts.

i) Engineering & Management:

- The DOT will conduct an annual inspection of its borrow sites and stream crossings during the 7-years of the project. Each site will be inspected for at least a 3-year period. Results will be included in an annual monitoring summary submitted by the project engineer to the DOT project director. Specific reference will be made to:

- erosion control measures implemented
- stream crossing installations, obstructions, adequate flows, velocity barriers siltation.
- rehabilitation of borrow areas, i.e., how successful in engineering and visual-aesthetic terms.
- construction camp area rehabilitation and operations.

ii) Natural Resources:

- During the 7-year construction period DOT intends to monitor and record factors normally within their jurisdiction such as: number of road killed animals, particularly caribou and moose.
  - incidents among the workers with respect to illegal harvest,
  - water contamination incidents, and
  - materials handling

iii) Human (social) Environment:

DOT will monitor and report any observed infractions of the controls placed on the study area by Department of Forest Resources and Lands during the preparation of the "plan". Beyond this function DOT would be outside its jurisdiction and expertise and would rely on other departments for any monitoring functions related to the tourism-recreation impacts and socio-economic and socio-cultural changes as recommended in Chapter 6.

7.4 Summary

DOT intends to conduct both compliance and "effects" monitoring of this project, however these activities will be within the normal DOT jurisdiction, e.g., as per the DOT specification forms. Before the project is fully underway a multi-agency scoping meeting, chaired by DOT will be called to finalize an implementable monitoring program with assignments of responsibility finalized. Monitoring results will be reported in monthly and annual summaries submitted by the environmental engineer/planner to the DOT project director.

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ENVIRONMENTAL IMPACT STATEMENT

APPENDIX

ROSS BAY JUNCTION - CHURCHILL FALLS TOTE ROAD

TRANSPORTATION
GOVERNMENT OF NEWFOUNDLAND & LABRADOR

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APPENDIX "A"

The Environmental Assessment Process

Newfoundland and Labrador

Extract from:

Environmental Assessment
A Guide to the Process
Government of Newfoundland and Labrador
Department of Environment
Environmental Assessment Division 1984

The Environmental Assessment Process

Step One: Registration

Every proponent who is planning an undertaking that may have a significant effect on the environment is required to register the project with the Minister of Environment. A special form for this purpose is available from the Department. (See Schedule 3)

It should be remembered that such undertakings are not just large manufacturing plants, mills, or land developments. They also include smaller projects such as trailer parks, sawmills, waste disposal sites, trails, gravel pits, or commercial harvesting of wild plants.

If you are planning an undertaking, large or small, which involves land use, forests, water or animal life; or if it may have an impact on community activities or recreation, then you may be required to register the project.

The responsibility for registering lies with the proponent. Please investigate your liability in this respect.

Registration, using the forms provided, is a relatively simple process and may prevent costly delays and unnecessary expense for the undertaking.

Step Two: Examination

Within ten days of the time a registration is received, the Minister of Environment will announce publicly that he has received it and will offer to make it available to interested members of the public. The Minister will also invite written comments to be submitted by the public within a 30-day period.

The registration will be examined by various government departments and a recommendation will be made to the Minister. The Environmental Assessment Division of the Department coordinates this examination.

Step Three: Minister's Decision

Within forty-five days of having received the Registration, the Minister of Environment will advise the proponent of his decision on the proposal.

This decision could take one of three forms:

1. **The undertaking may proceed** as indicated in the registration proposal, subject of course to any other appropriate Acts or Regulations at any level of government.
2. **An Environmental Preview Report is necessary.** This document (EPR) would provide more detailed information than is contained in the Registration form and would present preliminary information concerning the effects which the undertaking would have on the environment, based on readily available information. As in the case of Registration, the Department will provide guidelines to assist the proponent in preparing the EPR. It should be noted that a Preview Report is rarely required. It is more likely that an Environmental Impact Statement will be requested, if an assessment is needed.
3. **An Environmental Impact Statement is required.** This document (EIS) is a complete description of the undertaking, stating the need for it in terms of present and future demands, the existing environment relating to the undertaking, and the impact which the undertaking will have on that environment. Once again, the Department will provide guidelines to assist the proponent.

The Minister will announce his decision publicly within ten days of having advised the proponent.

It is important to note that until this step has been completed, no work may proceed on the undertaking. Furthermore, no such work may be carried out if the Minister has ordered an environmental preview report or an environmental impact statement.

Step Four: Proponent's Action

The Minister's decision determines the action to be taken by the proponent. As noted in Step Three, there are three possible courses of action:

1. **The project proceeds.** If the decision indicates that no further information is required, and there is no necessity for an Environmental Impact Statement or a Preview Report, then the proponent may seek approval immediately for the proposed undertaking, from appropriate regulatory bodies or agencies, as the Minister's decision does not replace or over-ride normal requirements for permits or licenses from other departments of the provincial or federal governments, or from municipal authorities.

   It is important to know that there is a time limit on the effect of the discharge issued by the Minister. The decision is effective for a period of three years from the date that the proponent is advised of the decision. If work has not begun on the project within that time, the original decision becomes void, and the undertaking must be registered once again.

2. **An Environmental Preview Report is prepared.** If, in exceptional cases, the Minister requests an EPR, it is because the review of the registration indicates that it may be necessary to require an Environmental Impact Statement for the proposed undertaking. The purpose of the EPR is to provide sufficient information on the project to determine whether an EIS is required.

3. **An Environmental Impact Statement is compiled.** The Minister may require the proponent to submit an Environmental Impact Statement if an examination of the initial registration or a subsequent Environmental Preview Report indicates that significant harmful environmental impact may result from the undertaking.

   To assist the proponent in this process, the Minister will provide guidelines for the preparation of the EIS.

   The first step for the proponent is to consult with officials of government and with interested members of the public to determine how their concerns will be addressed in the terms of reference for the Statement.

With this information in hand, the proponent then prepares draft "Terms of Reference" and forwards twenty-five copies to the Minister. The draft terms must indicate that the EIS will include:

- a description of the proposed undertaking
- the reason for the undertaking
- other methods of carrying out the undertaking;
- alternatives to the undertaking;
- a description of the present environment that would be affected, directly or indirectly;
- a description of the future environment, predicting its condition if the undertaking did not take place;
- the effects that may be caused to the environment;
- actions that may be necessary to alter or remedy the effects on the environment;
- an evaluation of advantages and disadvantages to the environment of the undertaking
- proposed measures to control, remedy, or minimize all significant harmful impacts;
- a proposal for a program to monitor all toxic substances and other harmful impacts produced by the undertaking during its construction and operational stages;
- proposals for a program of public information.

The draft terms of reference must also include a commitment to describe impacts which may occur to the environment despite the controls and remedies proposed; list all sources of information to be cited in the EIS; outline the design of any component studies necessary for the preparation of the EIS; and include in the EIS specific responses to concerns of the public and proposed measures to deal with these concerns. There must also be a commitment to provide copies of all reports on original studies undertaken as soon as they become available.

When the draft terms are sent to the Minister, he will announce their receipt within ten days and make them available to interested members of the public. Written comments will be invited from the public but must be received within thirty-five days of the notice.

The draft terms of reference are then studied by an Assessment Committee, which will make a recommendation on whether the draft terms are acceptable, or are not acceptable and therefore must be revised.

If the terms are acceptable, the Minister will advise the proponent that they are satisfactory to form the Terms of Reference for the Environmental Impact Statement. This notice will be given within forty-five days of receipt of the draft terms by the Minister, and will be made public within a further ten days.

Where **component studies** are necessary in the preparation of the EIS, separate draft terms of reference must be prepared and submitted to the Minister for similar review and decision on their acceptability.

Once the Minister's approval of all the terms of reference has been received, the proponent may start work immediately on the preparation of the Environmental Impact Statement and any associated component studies.

In the course of gathering data for the EIS, the proponent is required to initiate a public information program for the area affected by the undertaking. Through such a program, local residents will be fully informed of the nature of the project and its effects on the environment, and copies of all reports on original studies undertaken for the EIS will be made available. The concerns of the public will be recorded and must be addressed in the EIS.

Public notice of the assessment process for the undertaking will be issued by the Minister through newspapers, the Newfoundland Gazette, and/or by announcements posted in public places.

Step Five: EIS Review and Decision

Once the Environmental Impact Statement is completed, the proponent forwards it to the Minister, who will announce its receipt within ten days. A maximum of fifty copies of the statement should be provided by the proponent as required by the Minister.

Copies will be made available to interested members of the public, and written comments will be invited and received within a forty-five day period.

The Assessment Committee will examine the EIS and make a recommendation on whether or not it follows the approved terms of reference and is acceptable according to the Act and Regulations.

If the EIS is not acceptable, the Minister may require the proponent to conduct further work, to amend the statement, or to re-submit a revised statement at a later date.

If strong public interest or concern over the undertaking is indicated, the Minister may request the Cabinet to appoint an Environmental Assessment Board to hold public hearings relating to the assessment. This Board will consist of from two to five persons who are not employed by government. The Chairman will not be a resident of the area affected by the undertaking, but one-third of the Board's membership will reside in the geographic area, and the hearings themselves will be held there. The information received at these hearings, together with the final report and any recommendations of the Board, will be made public.

When the Assessment Committee has completed its work, and — if public hearings were held — the report of the Environmental Assessment Board is received, the Minister will make his final recommendation to Cabinet on the undertaking in question.

This recommendation will ask Cabinet either to permit the undertaking to proceed or not to permit it.

The final decision is made by Cabinet.

When discharged by the Minister, the proponent may seek approval for the undertaking, subject to the requirements of other Acts, Regulations, licences or permits at all levels of government.

Penalties

Proponents who fail to comply with the requirements of the Environmental Assessment Act may be subject to penalties of up to $5,000 (or in default, up to six months in prison) for a first offence; and up to $10,000 (or in default, up to twelve months in prison) for a second or subsequent offence.

Exemptions

If it is considered in the public interest, the Minister may — with the approval of Cabinet — exempt an undertaking from the provisions and requirements of the Environmental Assessment Act or Regulations. The Minister may also decline to disclose documents or matters that are not in the public interest.

Notice of any exemptions, and the reasons for them, will be published by the Minister.

Act and Regulations

Readers are strongly advised to consult the complete text of the Environmental Assessment Act and Regulations before proceeding with the registration of an undertaking.

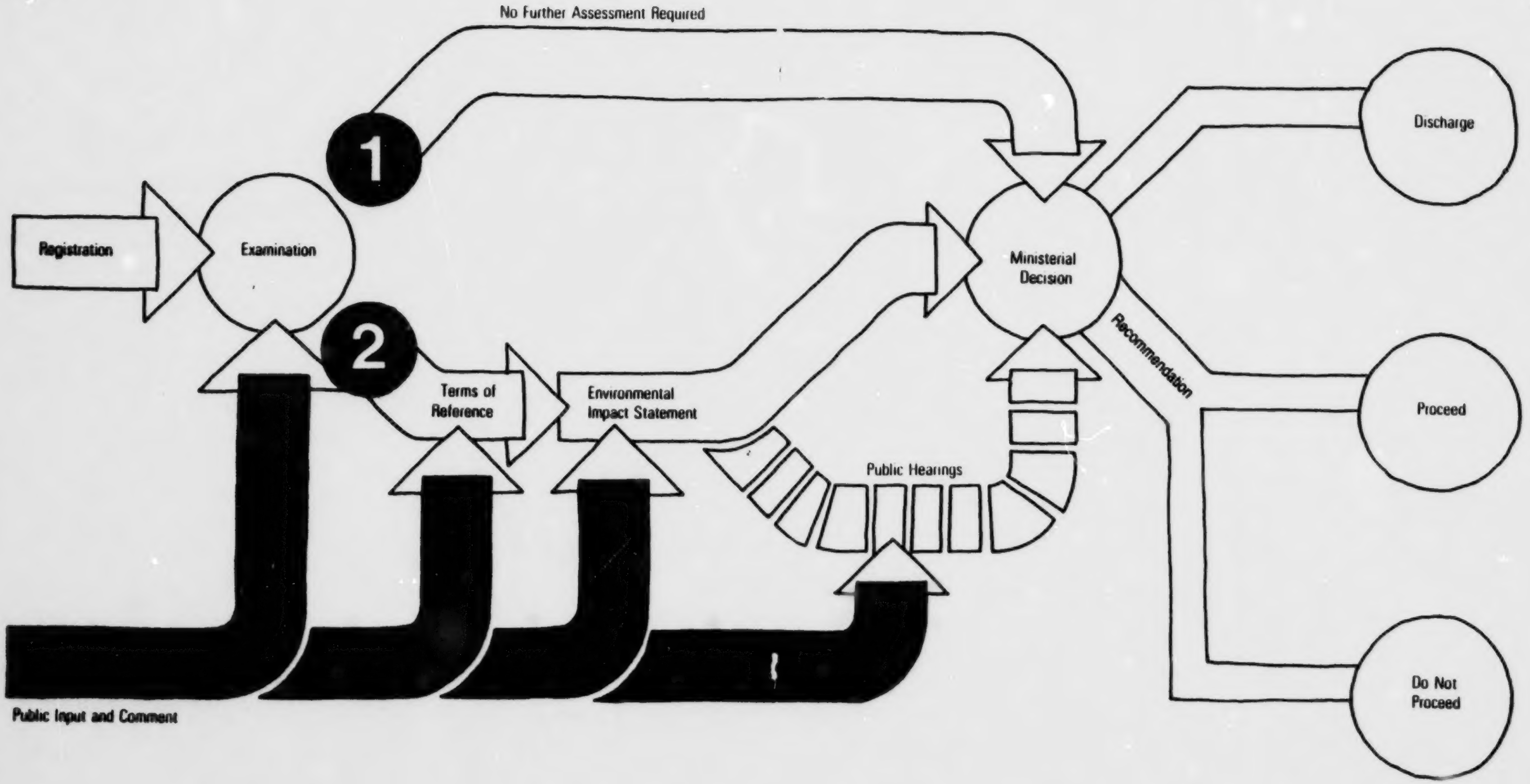
These Regulations stipulate time frames and deadlines for all phases of the assessment process, and the legal details of the requirements described briefly in this Guide.

This booklet is intended to provide background information on environmental assessment in Newfoundland, its importance to the people of the Province, and the process by which it is administered. It is not to be considered a final authority or legal document.

After reading this Guide and studying the Regulations and the Act itself, if any readers have further questions they are invited to contact the Department of Environment for additional information or explanation. Copies of the Act, Regulations, and other material relating to environmental assessment are available upon request.

The Environmental Assessment Process

Sequence Diagram


No Further Assessment Required
1
Registration
Examination
2
Terms of Reference
Environmental Impact Statement
Public Hearings
Ministerial Decision
Recommendation
Discharge
Proceed
Do Not Proceed
Public Input and Comment

APPENDIX "B"

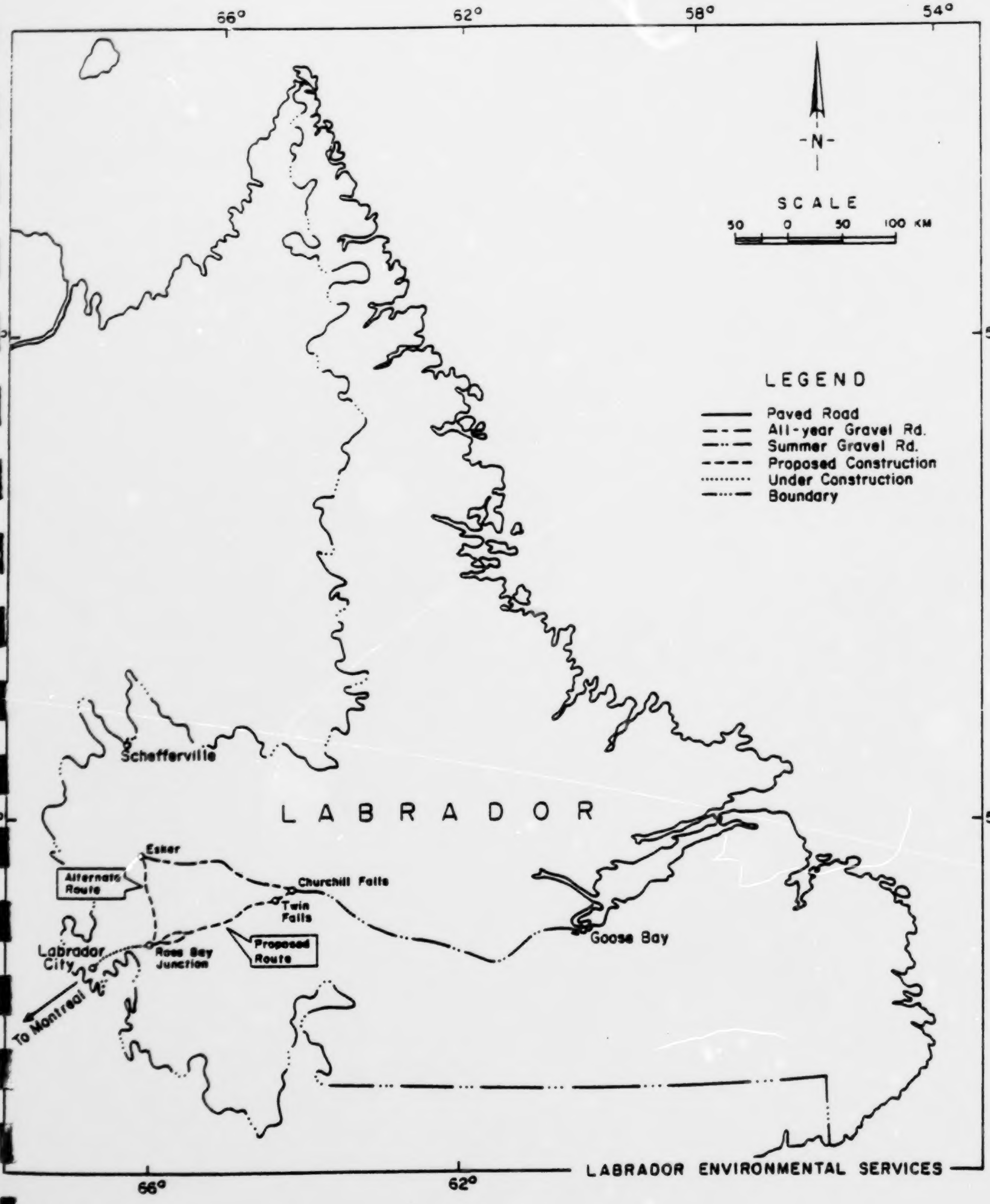
Terms of Reference agreed to between the Department of Transportation and the Department of Environment.

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

TERMS OF REFERENCE FOR THE PREPARATION OF THE ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED TOTE ROAD BETWEEN ROSS BAY JUNCTION AND TWIN FALLS, LABRADOR

HIGHWAY PLANNING AND RESEARCH
DEPARTMENT OF TRANSPORTATION
ST. JOHN'S, NEWFOUNDLAND

MAY, 1983


66°
62°
58°
54°
-N-
SCALE
50 0 50 100 KM
58°
54°
LEGEND
Paved Road
All-year Gravel Rd.
Summer Gravel Rd.
Proposed Construction
Under Construction
Boundary
Schefferville
LABRADOR
Esker
Alternate Route
Churchill Falls
Twin Falls
Goose Bay
Labrador City
Ross Bay Junction
Proposed Route
To Montreal
66°
62°
LABRADOR ENVIRONMENTAL SERVICES

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1.0 Definitions

TERMS OF REFERENCE (for the EIS)

Terms of Reference are written policy and action commitments by which the proponent of the project will undertake to prepare an Environmental Impact Statement for submission as required under the Environmental Assessment Act (1980).

PROJECT AREA

The roughly triangular area of the route corridors bounded on the north by the existing BRINCO road, on the south by the PROPOSED route from Ross Bay Junction to Twin Falls and on the west by the ALTERNATIVE route from Ross Bay Junction to Esker.

VALUED ECOSYSTEM COMPONENT

An environmental attribute considered and expressed by the general public and/or the professional community to be important in project decisions.

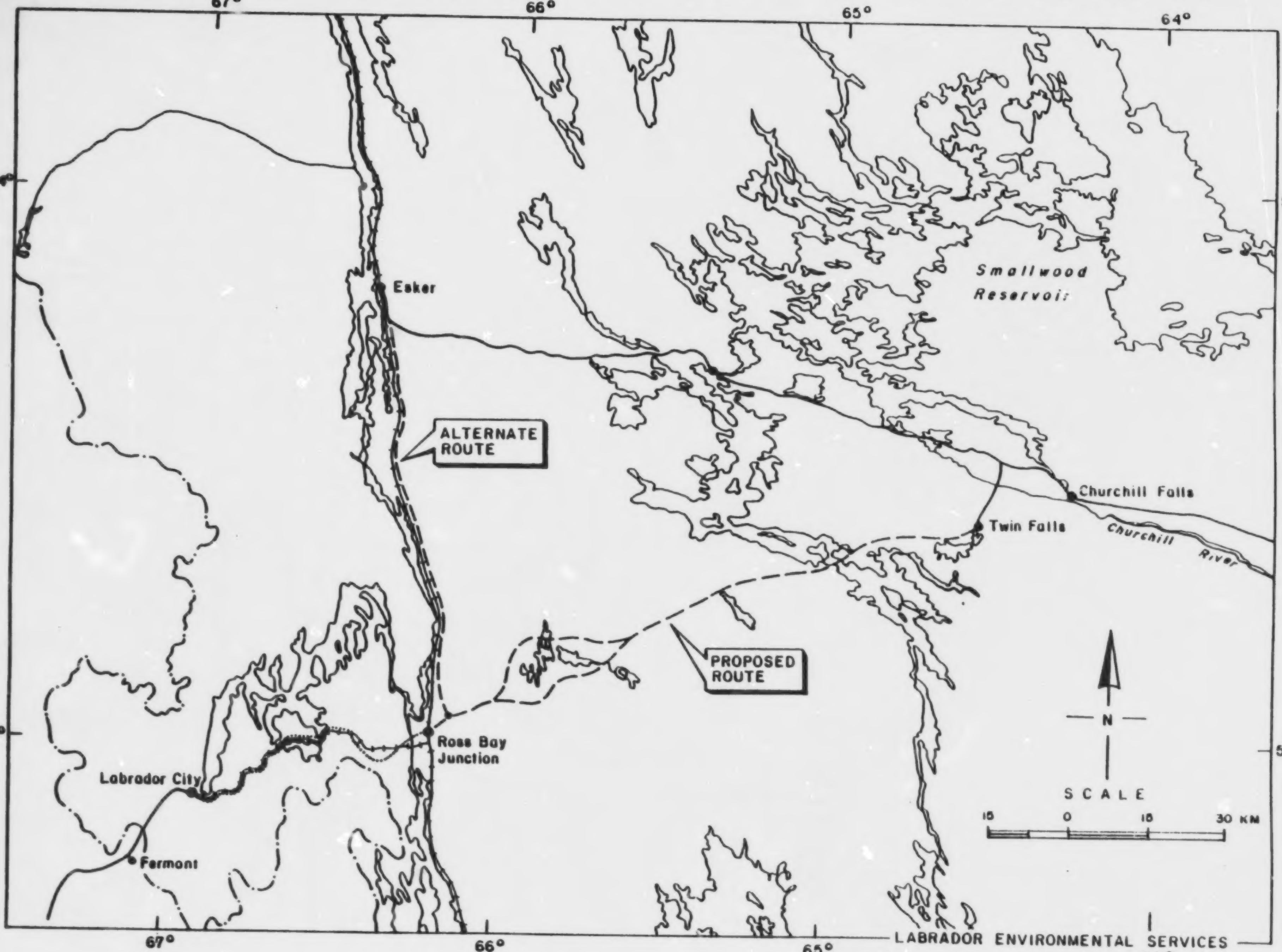
INNU

A distinctive Indian cultural group which has traditionally utilized the natural resources contained within the project area.

INUEIMUN

The language of the Innu.

2.0 Detailed map of the PROPOSED and ALTERNATIVE routes.


67°
66°
65°
64°
54°
54
53°
53
Smallwood Reservoir
Esker
ALTERNATE ROUTE
Churchill Falls
Twin Falls
Churchill River
PROPOSED ROUTE
N
Ross Bay Junction
Labrador City
Fermont
SCALE
15
0
15
30 KM
67°
66°
65°
66°

LABRADOR ENVIRONMENTAL SERVICES

3.0 Terms of Reference for the Preparation of the Environmental Impact Statement for the Tote Road between Ross Bay Junction and Twin Falls, Labrador.

3.1 Introduction

3.1.1 Notice

The following Terms of Reference were prepared for the Department of Transportation by Labrador Environmental Services. These Terms of Reference provide specific commitments to activities, analyses, and policies which will guide the proponent in its preparation of the Environmental Impact Statement for the proposed road link between Ross Bay Junction and Twin Falls and the alternative road between Ross Bay Junction and Esker.

For the purposes of these Terms of Reference the following discussions and commitments about the assessment of impact and the Environmental Impact Statement pertain to both the PROPOSED and the ALTERNATIVE routes unless otherwise indicated.

3.2 Summary of the Environmental Impact Statement

3.2.1 Summary

A summary of the major findings of the Environmental Impact Statement will be provided in English and Inueimun.

3.2.2 Proponent identification and mandate

The Environmental Impact Statement will identify as the proponent the Department of Transportation of the Government of Newfoundland and Labrador. The proponent will provide pertinent regulatory and legislative statements regarding its responsibility and mandate to carry out the proposed undertaking.

3.2.3 Project assessment history

The Environmental Impact Statement will contain a summary outlining the regulatory process undergone for the project to meet the requirements of the Environmental Assessment Act (1980).

3.2.4 Additional concerns

The proponent commits to address additional concerns of merit which it may first identify during the process of preparing the Environmental Impact Statement.

3.2.5 Metric

All measurements and descriptions in the Environmental Impact Statement will use the metric system.

3.3 Need for project

The Environmental Impact Statement will describe the nature of the project and will contain a discussion of the need for the project.

3.4 Project description

The following section (3.4.1 - 3.4.9) describes the project and the format by which it will be described in the Environmental Impact Statement.

3.4.1 Introduction

The Department of Transportation has selected two routes for study in the Environmental Impact Assessment: the preferred route, hereafter referred to as the PROPOSED route, spans the 142 km between Ross Bay Junction and Twin Falls; the ALTERNATIVE route runs north for 90 km from Ross

Bay Junction to join the established BRINCO road at the point approximately 12 km southeast of Esker.

3.4.2 Road corridors

The Department of Transportation will delimit on maps at a scale of 1:250,000 the two corridors considered in development of the routes. The corridor widths shall be 5 km.

3.4.3 Road alignment

The Environmental Impact Statement will contain maps at a scale of 1:50,000 showing the expected alignment of the road (accurate to within 1 kilometre) and possible deviations (defined to within 100 m) being considered for use in assessing potential environmental impacts. These maps will also show the location of borrow pits and other project sites which are expected to result during construction activities. Routing maps shall include mileposts (chainages) for each route.

3.4.4 Design and construction standards

The Environmental Impact Statement will describe engineering and construction standards so that the general public and readily determine the quality of road resulting from this project. The E.I.S. will specify the standards to be used in design and construction of the project in order to implement and facilitate environmental protection measures during and after construction. These standards will be included in final tender documents.

3.4.5 Construction schedule

A general schedule of construction activities will be included in the Environmental Impact Statement based on the best information available at the time of compilation of the Environmental Impact Statement.

3.4.6 Construction costs

The Environmental Impact Statement will provide an estimate of overall costs based on the current information available to the Department of Transportation.

3.4.7 Maintenance costs

The Environmental Impact Statement will contain a comparative estimate of the total annual maintenance requirements of both road links between Ross Bay Junction and Churchill Falls.

3.4.8 Manpower requirements

The Environmental Impact Statement will contain an estimate of the manpower required to construct either road link, expressed in person-months or person-years for the duration of the project.

3.4.9 Alternative transportation options

The Environmental Impact Statement will contain an analysis of the transportation options available to Labrador residents other than the construction of the tote road.

3.4.10 Construction Infrastructure

The proposed location and size of all main and temporary work camps, marshalling areas, equipment maintenance areas and waste disposal sites shall be described.

3.5 Existing environment

This environment in the project area shall be described according to the best information available utilizing published literature, reports and professional opinions prior to development impact.

3.5.1 Geology, geomorphology, and soils

The Environmental Impact Statement will contain a general description of the geology, geomorphology and soils contained within the delimited PROPOSED and ALTERNATIVE tote road routes (see 3.4.3) including mapping at a scale of 1:50,000 to identify areas such as eskers, peatlands and other sensitive sites (see Appendix A). A general description of the geology shall be shown using published map data at a 1:250,000 scale or smaller. A brief description of known mineral potential shall be included. A description of existing granular resources shall be included in the geomorphology and soils subsections.

3.5.2 Vegetation

A general description of the vegetation types contained within the delimited PROPOSED and ALTERNATIVE routes will be provided in the Environmental Impact Statement, including mapping at a scale of 1:250,000. Major plant associations will be plotted on the maps (see Appendix A).

3.5.3 Caribou, fish and other wildlife

A general description of the animal biota of the region will be included in the Environmental Impact Statement. Animals identified as being of particular interest such as caribou, fish and possibly others, will receive original research as required. This will include the conducting of a one year study of caribou movements and populations in the project area, a survey of fish stocks on both routes, and incidental information gathering on other wildlife. Details of fish surveys shall be developed in conjunction with the Department of Fisheries and Oceans. The results of the research will be incorporated into the E.I.S. A subsection on Other Wildlife shall contain general information on species which may be discovered during the course of wildlife field work. Unless the species encountered are very rare or are of great economic value, the information shall be appended to the E.I.S. rather than included in the main text. Impact predictions shall only be made where exacting survey techniques are used.

3.5.4 Climate

The Environmental Impact Statement will contain a general climatological description of the project area based on existing meteorological records from Wabush/Labrador City and Churchill Falls, and from other appropriate sources (see Appendix B).

3.5.5 Historic resources

A description of prehistoric and historic land use in the project area will be contained in the Environmental Impact Statement based on literature, archival and original field research, and informant interviews.

3.5.6 Socio-economics

A socio-economic description of the populace and cultures within the region to be impacted by the provision of a road link into eastern Labrador from the rest of mainland North America will be included in the Environmental Impact Statement.

3.6 Valued ecosystem component identification

This section (3.6.1. - 3.6.2.13) describes the principle concerns and interests to be addressed by the Department of Transportation during the course of the environmental impact assessment.

3.6.1 Identification procedure

The Environmental Impact Statement will contain a record of the steps taken to determine valued ecosystem components and the subsequent measures taken to address these components.

3.6.2 Valued ecosystem components

Valued ecosystem components to be specifically addressed in the Environmental Impact Statement have been and will continue to be determined in consultation with the general public of the region expected to be impacted and the scientific community and regulatory authorities of the province. The valued ecosystem components identified to date are discussed below in 3.6.2.1 - 3.6.2.13.

3.6.2.1 Public assessment of the PROPOSED and ALTERNATIVE routes

A number of individuals and public groups have identified a need for public discussion and information on the choice of the PROPOSED or ALTERNATIVE road link. The Department of Transportation undertakes to conduct public information sessions in the region to be impacted (Labrador) (see Appendix C). The concerns and issues raised by this process will be a factor in the evaluation of the PROPOSED and ALTERNATIVE routes.

Public information sessions will be conducted in English with Inueimun translation services provided as required.

3.6.2.2 Socio-economic factors

Almost every contact (see 4.0) made in Labrador during preparation of the Terms of Reference for the Environmental Impact Statement indicated a concern or interest in the impact that the road link would have on the social, cultural and economic fabric of Labrador. It is recognized that with the completion of the tote road, central Labrador will have direct road connections with the rest of mainland North America; as well the road may relate to other development projects in the region.

The road link will have significant impact on the region. It is also recognized that the construction activities will have significant economic and social impacts during the development phase. The Department of Transportation therefore intends to have undertaken a social, cultural and economic analysis of the impacts expected to result from the construction and completion of this project (see Appendix D). Secondary development potential such as land development, mineral exploration, tourism and forestry, adjacent to the tote road and prediction of impacts shall be carried out.

3.6.2.3 Native resource use

The resource harvest carried out by natives and other use patterns and how they may be affected by the proposed development shall be described.

3.6.2.4 Tourism and recreational use of natural resources

Concern frequently has been expressed with regard to the impact that tourists and other visitors to the region who utilize the completed tote road will have on the natural resources of the area such as fish, wildlife, and wilderness. Much interest also has been expressed about the potential economic benefits accruing to the region from a flow of tourists and other visitors into and through the project area and through the region in general. The Department of Transportation will conduct an analysis of the possible and probable effects of sudden and considerable increased use of natural resources in the area, and to provide an impact analysis in the Environmental Impact Statement (see Appendix E).

3.6.2.5 Twin Falls hydroelectric facility

The temporarily inoperative Twin Falls hydroelectric plant and associated facilities such as forebays, dykes, service roads and transmission lines may be in close proximity to the PROPOSED route. Unauthorized access to these facilities may be gained from either the PROPOSED or ALTERNATIVE routes. The potential thus exists for conflicts to arise in land use and maintenance of security measures related to the Twin Falls hydroelectric project. The Department of Transportation therefore commits to establishing and maintaining a close liason with the managers of the Twin Falls hydroelectric project to ensure that conflicts are avoided during and after the design and construction stages of the PROPOSED or ALTERNATIVE route.

3.6.2.6 Caribou, fish and Other wildlife

The project area has received minimal amounts of research into numbers, distribution and general ecology of mammalian, avian and piscine populations.

It is known that in the 1950's and 1960's large numbers of caribou utilized the project area. These numbers appear to have declined considerably, but insufficent data are available on past and present use of the area with regards to distribution and movement patterns. In order to assess the potential impact of the project upon caribou in the area it is necessary to know their pesent numbers, distribution and movement patterns. The Department of Transportation therefore will have original field research conducted on the caribou in and about the project area for a period of one year (see Appendix F). This work shall also assess the size and productivity of the caribou herd(s). Results of this research will be reported in the Environmental Impact Statement and the information used in assessing the impact of the PROPOSED and ALTERNATIVE tote road routes. The Department of Transportation also commits to participating with the Wildlife Division in conducting a monitoring program for one year following the above mentioned research for the E.I.S.

In order to protect fish populations and habitat the Department of Transportation commits to the use of

Case and Rowe (1978) guidelines as standards in design and construction for the PROPOSED and ALTERNATIVE routes. Upon final routing decisions and prior to any development of design for crossing streams and other water bodies, and prior to any construction activities, the Department of Transportation will collaborate with the Department of Fisheries and Oceans so as to ensure the continued long term viability of fish populations and habitats in relation to design and construction practices of the tote road. The Department of Transportation shall liase with the Department of Fisheries and Oceans in developing acceptable survey techniques and identifying the types of information required to address potential impacts.

Following a preliminary archival and informant survey of both corridors to gather information on fish populations and the present level of the exploitation of these stocks, the Department of Transportation, in consultation with the Department of Fisheries and Oceans, will have an aerial and a ground survey of the PROPOSED route conducted to establish more clearly fish species, age, movements and habitat, and to study the hydrology of the major crossings and water bodies. An assessment of anticipated impacts will be in the E.I.S. and mitigation measures developed for each significant water crossing, and these measures approved by the Department of Fisheries and Oceans, in order to minimize disturbance to fish stocks and habitat.

A subsection on other wildlife shall include significant findings and statements on impact prediction on furbearers, raptors, waterfowl and other wildlife.

3.6.2.7 Forest resources

Commercial forest resources in the project area are extremely limited; however timber resources in the

PROPOSED and ALTERNATIVE tote road rights-of-way have some value for domestic and other local use. As well, the forests of the project area are habitat for a wide variety of animal life. Habitats well removed from the PROPOSED or ALTERNATIVE routes could be threatened by forest fires caused by construction activities and users of the road and hinterland. The Department of Transportation intends to establish design standards for the tote road construction which wll ensure that the useable timber resources of the right-of-way are appropriately placed so as not to preclude domestic or other local use. The Department of Transportation also commits to analyzing and addressing the matter of forest fire potential; possible preventative measures will be adopted during construction in consultation with the appropriate authorities.

3.6.2.8 Historic resources

Very limited investigation of prehistoric and historic land use of the project area has been conducted. It is anticipated from analysis of contemporary Innu movements and from information contained in early historic literature that the potential is high for archaeological sites to be found within the project area. The Department of Transportation commits to a study involving informant interviews and field surveys of the PROPOSED and ALTERNATIVE routes to establish past land use patterns (see Appendix G). The findings will be summarized in the Environmental Impact Statement and used to determine final detailed design and to conduct route evaluations. Avoidance or other measures established by the Historic Resources Division of the Department of Culture, Recreation and Youth will be employed where archaeological resources are discovered in the road corridor and where readily accessible from the road corridor.

3.6.2.9 Geology, geomorphology and soils

To maximize the preservation of habitat and aesthetic appeal of the selected route, standards of design and construction must include provision for mitigation and rehabilitation.

The Department of Transportation will co-operate with the Department of Mines and Energy to assess the applicability to the project area of acceptable environmental protection guidelines as contained in the permit requirements of the Department of Mines and Energy. The resultant effort will specify planning, design and construction policies and practices to be implemented in the project given the specific conditions, expected impacts and available natural resources and construction techniques. Planning and implementation of rehabilitation policies regarding borrow pits, quarries, shoulders, push lanes, construction camps, access roads, fuel storage areas and waste disposal sites will be developed in conjunction with the Department of Environment. The Environmental Impact Statement will also specify the policies and practices to be implemented in design and construction activities involving eskers and peatlands. Impacts on mineral potential and on mineral exploration activities within the road corridor shall be discussed. The mitigative measures to ensure proper utilization of granular resources. A discussion on the mitigation measures to ensure proper utilization of granular resources by avoiding the alienation of resources by route selection or construction techniques shall be included in the Environmental Impact Statement.

3.6.2.10 Water resources

Concern has been expressed about maintaining control of the activities of construction contractors in relation to stream alteration works. The Department of

Transportation will consult with the Water Resources Division of the Department of Environment during the design, construction and rehabilitation phases of stream alteration works and, through a compliance monitoring programme, will ensure that construction contractors are in possession of all appropriate permits prior to undertaking any stream alteration works and that they observe all environmental protection requirements. These policies and practices will be reflected in the Environmental Impact Statement.

3.6.2.11 Special areas

It is known that at least one special area (an International Biological Programme site) exists in the project area. It is expected that other natural areas of special significance will be located during the course of the environmental impact assessment.

The Proponent will seek advice on potential special areas from the Wilderness and Ecological Reserves Advisory Council, the Memorial University Herbarium, the Natural History Society and other advisory bodies with knowledge of rare plants, fossils and other unusual natural phenomena.

The Department of Transportation commits to establishing procedures whereby special areas, if and when identified, will receive designation and recognition within the assessment process and will be evaluated in relation to possible routings. All such special areas will be reported in the Environmental Impact Statement.

3.6.2.12 Mitigation

Concern has been expressed on a number of occasions that road building activities will unduly pollute or damage water bodies, land surfaces and the natural and historic resources of the project area. In the foregoing sections the Department of Transportation has established certain policies and practices which they feel will control adequately the level of disturbance and provide the required mitigation measures. Should further concern develop regarding terrain or water body disturbance the Department of Transportation, through consultation with the appropriate authorities or groups, will address these concerns during preparation of the Environmental Impact Statement and during the period of construction. In addition, contingency plans will be in place for dealing with oil spills or leaks of other harmful substances, should these occur. Mitigation for operational and maintenance phases will be discussed.

3.6.2.12 Rehabilitation

The Department of Transportation commits to rehabilitate all disturbed areas in accordance with the requirements of the Department of Environment. Specific procedures and techniques shall be included in tender documents to ensure that affected areas are rehabilitated.

3.6.2.13 Approvals

A number of official permits and approvals will be required for the construction activities. The Dept. of Transportation will ensure through contractual or other mechanisms that all required regulatory permits and approvals are obtained prior to construction and that contractors and workers are educated about environmental protection requirements and fully appreciate the legal requirements. The Department of Transportation commits to fully co-operate with the Department of Environment in an environmental surveillance program to ensure compliance with statutes, policies, guidelines and conditions of approval.

3.7 Impact predictions for the PROPOSED and ALTERNATIVE routes

The Environmental Impact Assessment will contain impact predictions based upon all available information, including any original research. Impact predictions will be provided for:

- Socio-economics
- Native resource use
- Tourism and recreational use of natural resources
- Twin Falls hydroelectric facility
- Caribou, fish and other wildlife
- Forest resources
- Historic resources
- Geology, geomorphology and soils
- Water resources
- Special areas
- Social

3.8 Evaluation of PROPOSED and ALTERNATIVE routes

The Department of Transportation will provide an evaluation of the PROPOSED and ALTERNATIVE routes based on environmental, social, engineering, construction and maintenance costs factors in the Environmental Impact Statement.

3.9 Route selection and rationale

A preferred route selection and the rationale for this selection will be included in the Environmental Impact Statement.

3.10 Appendices to the Environmental Impact Statement

3.10.1 A list of individuals and organizations consulted, public information sessions conducted and presentations received by the Department of Transportation during the process of preparing the Environmental Impact Statement will be provided in the E.I.S.

3.10.2 A list of literature sources cited will be provided in the Environmental Impact Statement.

3.10.3 The Dept. of Transportation will provide in the Environmental Impact Statement the specific terms of reference used for all original research sponsored by the proponent.

3.10.4 The Dept. of Transportation will provide in the Environmental Impact Statement a listing of all reports and documents produced in support of the statement and a list of locations where copies of these documents may be examined and/or obtained by the public.

3.10.5 The Dept. of Transportation will provide the names, academic qualifications and relevant work experience of those persons who will have been responsible for the various components of the Environmental Impact Statement.

4.0 Contacts made during the preparation of the Terms of Reference.

Bain, H.	Section Head, Habitat Research and Assessment Section, Department of Fisheries and Oceans.
Baker, Cpl.	Officer in Charge, R.C.M.P., Churchill Falls.
Bennett, W.	Inspector (and Planning Officer), Royal Newfoundland Constabulary.
Brett, H.	Town Councillor, Happy Valley-Goose Bay.
Burns, M.	Senior Planning Officer, Dept. of Municipal Affairs.
Bursey, B.	Director of Industrial Operations, Dept. of Development.
Cahill, M.	Forester, Forest Management Division, Dept. of Forest Resources and Lands.
Case, A. B.	Acting Program Manager, Canadian Forestry Service.
Cole, R.	Proprietor, Lobstick Lodge-Motel, BRINCO road.
Collette, D.	Vice-president, Operations and Engineering, Churchill Falls Corporation.
Conway, D.	Town councillor, Happy Valley-Goose Bay.
Durno, A.	Town Manager, Happy Valley-Goose Bay.
Felsberg, S.	Member, Mud Lake Local Service District.
Garland, B.	Products Development Specialist, Department of Forest Resources and Lands.
Goudie, I.	Wildlife Biologist, Canadian Wildlife Service.
Graham, T.	Program Co-ordinator, Department of Rural, Agriculture and Northern Development.
Hancock, J.	Environmental Biologist,Department of Culture, Recreation and Youth.
Jackson, D.	Asst. Co-ordinator, Michikamau Fisheries.
Kirby, G.	Director, Happy Valley-Goose Bay Development Corp.
Luttich, S.	Regional Wildlife Biologist (Labrador), Department Culture, Recreation and Youth.
McCubbin, R.	Habitat Technician, Department of Fisheries and Oceans.
Moores,B.	Project Biologist, Environmental Protection Service

Nuna, P.	Co-ordinator, Michikamau Fisheries
Penashue, G.	President, Naskapi Montagnais Innu Association.
Penunsi, S.	Resident, mile 61, BRINCO road.
Pone, M.	Resident, mile 61, BRINCO road.
Riche, L.	Resident, mile 61, BRINCO road.
Ryan, G.	Parks Planner, Department of Culture, Recreation and Youth.
Shouse, H.	Mayor, Happy Valley-Goose Bay.
Sproull Thomson, J.	Provincial Archaeologist, Department of Culture, Recreation and Youth.
Tanner, A.	President, Indian and Inuit Support Group of Newfoundland and Labrador.
Tsibidis, P.	Town Councillor, Happy Valley-Goose Bay.
Ullah, W.	Director of Water Resources Division,Department of Environment.
Vanderveer,D.	Senior Geologist,Department of Mines and Energy.
Vincent, C.	Town Manager, Labrador City.
Warren, K.	Town Manager, Wabush .
Watts, B.	Mayor, North West River.
Wells, D.	Wetland Ecologist, Canadian Forest Service, Environment Canada.
Williams, N.	Environmental Biologist, Department of Environment.

5.0 Bibliographies for the project area and the Terms of Reference

5.1 Project area

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APPENDICES

The following appendices contain general statements of the objectives and the methods by which the assessments will be conducted for the Environmental Impact Statement by the Department of Transportation and/or its agents.

APPENDIX A

RE: 3.5.1 and 3.5.2

Proponent's mechanism for obtaining information for inclusion in the Environmental Impact Statement on the geomorphology, soils and vegetation contained within the delimited PROPOSED and ALTERNATIVE tote road routes.

Objectives and methods

- To prepare maps based on aerial photograph interpretation techniques and at a scale of 1:250,000, which will describe the general vegetation patterns, terrain and soil types (otherwise known as ECODISTRICTS cf. Ecological Land Survey Guidelines for Environmental Impact Analysis, Environment Canada).
- To prepare maps at a scale of 1:50,000, based on aerial photograph interpretation techniques, which will identify soil types and areas such as eskers, peatlands, and other sensitive soil sites and vegetative cover (otherwise known as ECOSECTIONS cf. Ecological Land Survey Guidelines for Environmental Impact Analysis, Environment Canada) within the PROPOSED and ALTERNATIVE five kilometre-wide road alignment corridors.

APPENDIX B

RE: 3.5.4

Proponent's mechanism for obtaining meteorological data to prepare a general climatological description of the project area for inclusion in the Environmental Impact Statement.

Objectives and methods

- Review meteorological records from Labrador City/ Wabush, Churchill Falls and any other sources of data that are appropriate.
- Provide a general and a statistical descriptive report of the climate of the project area with particular reference to:
    - precipitation and fogs
    - wind direction and speeds
    - breakup and freezeup of water bodies
    - temperatures

APPENDIX C

RE: 3.6.2.1

Proponent's mechanism for providing public information sessions about the project in the region of the project.

Objectives and methods

- Two public information sessions will be held in each selected community of the region to be impacted. These meetings will provide project descriptions and elicit public comment and reaction to the proposed project.
- The public information sessions will be scheduled such that for each community one session will be held early in the E.I.S. preparation process and one late in the preparation process.
- Translation services in English and Inueimun will be provided where and if required at the public information sessions.
- Three weeks prior notice via public media will be given of the public information sessions for each community and four weeks prior notice to the Minister of Environment.
- Communities where information sessions will be held include:
    - Wabush/Labrador City
    - Lobstick (mile 61 BRINCO road)
    - Churchill Falls
    - Happy Valley-Goose Bay
    - North West River
    - Sheshatshit

APPENDIX D

RE: 3.6.2.2

Proponent's mechanism for determining and assessing the socio-economic impacts of the project to enable description and comment in the Environmental Impact Statement.

Objectives and methods

- To prepare a general description of the social, cultural and economic fabric of Labrador.
- To prepare a specific description of the social, cultural and economic fabric of the region to be impacted by the project.
- To prepare the foregoing descriptions by means of informant interviews, surveys, literature and data reviews and any other means deemed appropriate.
- To prepare an analysis of the data collected so as to provide specific predictions of the impact of the project on the social, cultural and economic fabric of the region.
- To examine secondary development potential, such as land development, mineral exploration, tourism and forestry adjacent to the tote road and predict what impacts will result.

APPENDIX E

RE: 3.6.2.4

Proponent's mechanism to identify and evaluate tourism and recreational use of natural resources in the project area, to identify and assess the level of impacts, and to recommend procedures for management of impacts in the Environmental Impact Statement.

Objectives and methods

- To identify and evaluate through literature and data reviews and local interviews the present level of tourism, recreational, and subsistence use of the natural resources in the project area (including fishing, hunting, trapping and travel).
- To identify and evaluate the expected level of increase in tourism, recreation, and subsistence use of the natural resources in the project area.
- To analyze the potential economic benefits accruing to the region from increased tourism and recreational use of the project area.
- To provide a detailed assessment of impacts on natural resources resulting from a sudden and considerable increase in tourism and recreational activities.
- To provide an impact management proposal which will alert the appropriate management authorities and provide for timely mitigation.
- To examine the harvest and use of resources and land by native groups, including travel, resource use and siste subsistence patterns.

APPENDIX F

RE: 3.6.2.6

Proponent's mechanism for obtaining information on the numbers, distribution and movement patterns of caribou in and around the project area and the numbers, ages, species, movements and habitats of fish in water bodies crossed by the selected route, for predicting the impact of the project on caribou, fish and other wildlife, and for proposing mitigation measures for inclusion in the Environmental Impact Statement.

Objectives and methods

- To determine the numbers, distribution and movement patterns of caribou in and around the project area over a one year period.

- To use radio telemetry techniques and aerial census techniques to determine the required information.

- To intensively monitor radio-collared caribou during the precalving and calving period, and on a monthly basis otherwise during a two year period.

- To prepare a literature review of other similar development projects and the known impacts on caribou.

- To provide an analysis and assessment of the predicted impact of the project on caribou in and around the project area.

- To collect information on fish populations and movements for both routes through documentary research and informant interviews and on the PROPOSED route through original field research to enable impact predictions to be developed, and mitigation measures which are approved by the Dept. of Fisheries and Oceans, to be recommended.

- To collect information on raptors, waterfowl, furbearers and other wildlife along the entire delineated route during the course of the caribou and fish studies or otherwise such that a general description of the wildlife of the region can be produced, impact predictions made of the project's effect upon them and mitigative measures recommended.
- To carry out field reconnaissance of major stream crossing sites with particular attention being given to the physical features of the crossing site, stream flow and water quality characteristics, benthic communities and fish fauna.

APPENDIX G

RE: 3.6.2.8

Proponent's mechanism to identify and evaluate historic resources within the delineated tote road routes and within easy access of the road development area, to identify and assess all impacts upon historic resources, and to recommend procedures for management of impact in the Environmental Impact Statement.

Objectives and methods

- To identify and evaluate historic resources within the areas established by the proponent as delimiting the PROPOSED and ALTERNATIVE route alignments and up to five kilometres distant on such features as eskers and major water bodies which intersect the routes.

- To conduct informant interviews in such communities as Sept Isles, Sheshashit, Lobstick, and Schefferville where Innu residents can provide information on the present and past land use patterns in the project area.

- To conduct aerially supported foot and watercraft surveys of each route and major intersecting features, including a programme of random test-pitting to be established and agreed upon with the Historic Resources Division.

-To provide a detailed assessment of impact upon historic resources by the project.

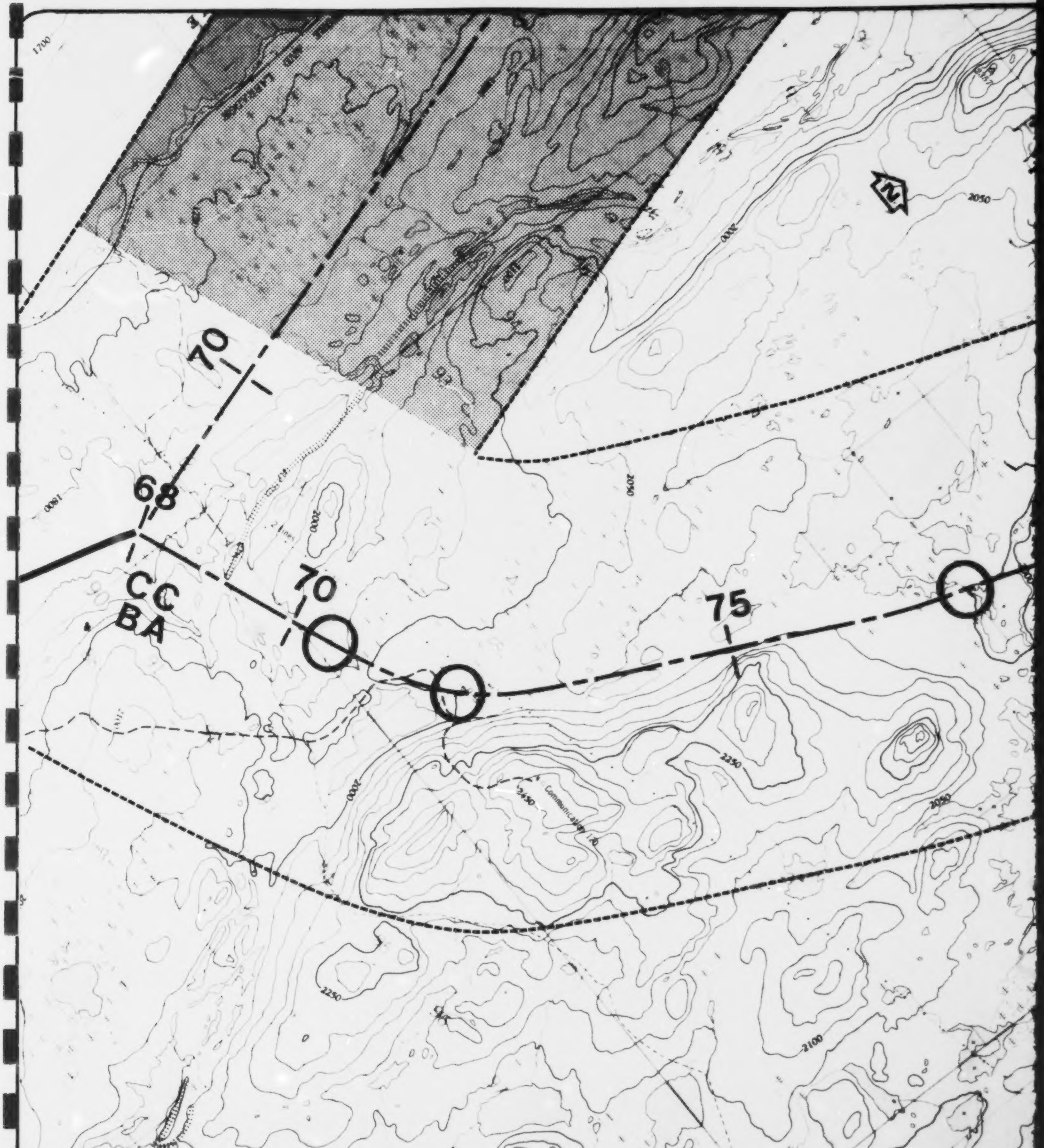
-To provide an impact management proposal.

-Archaeological contractors will be required to abide by the Impact Assessment and Impact Management Guidelines as established by the Historic Resources Division (1982).

APPENDIX "C"

PROPOSED & ALTERNATE ROUTE MAPS

Scale 1:50,000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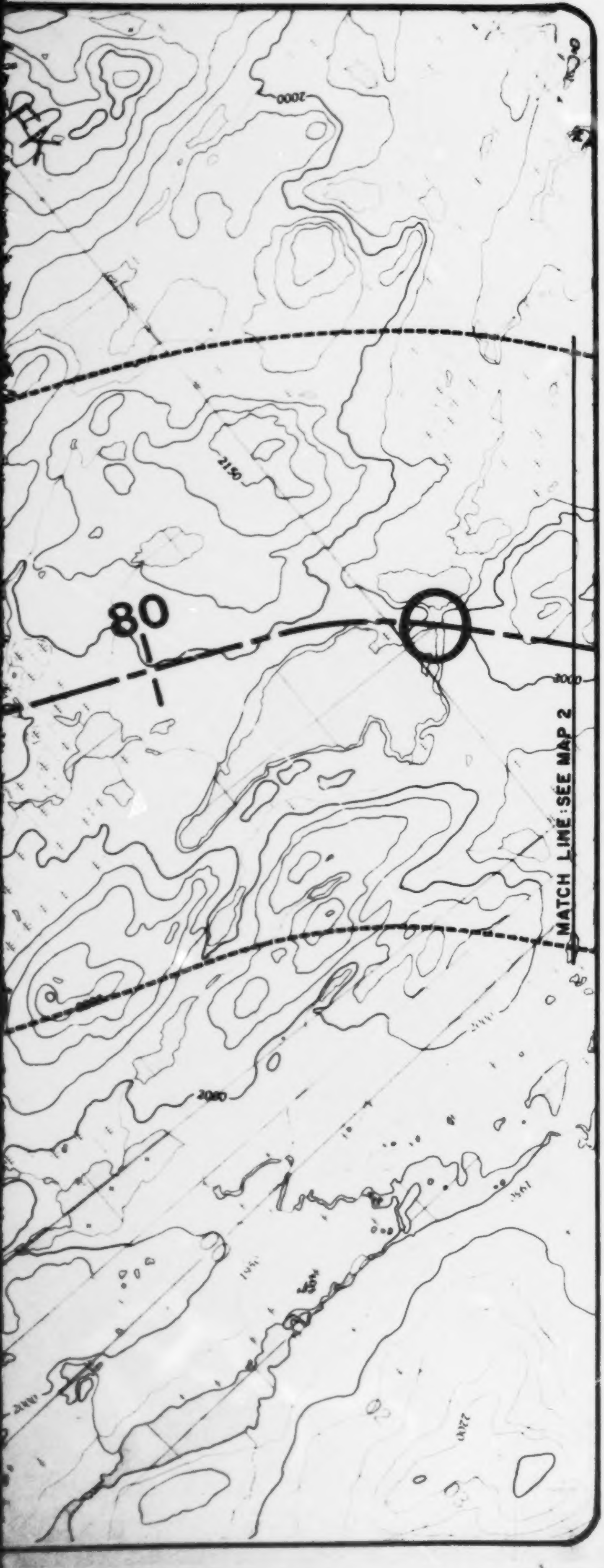
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ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
▨	ALTERNATE ROUTE

MAP 1

SCALE 1:50,000

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DATE: 1986/02

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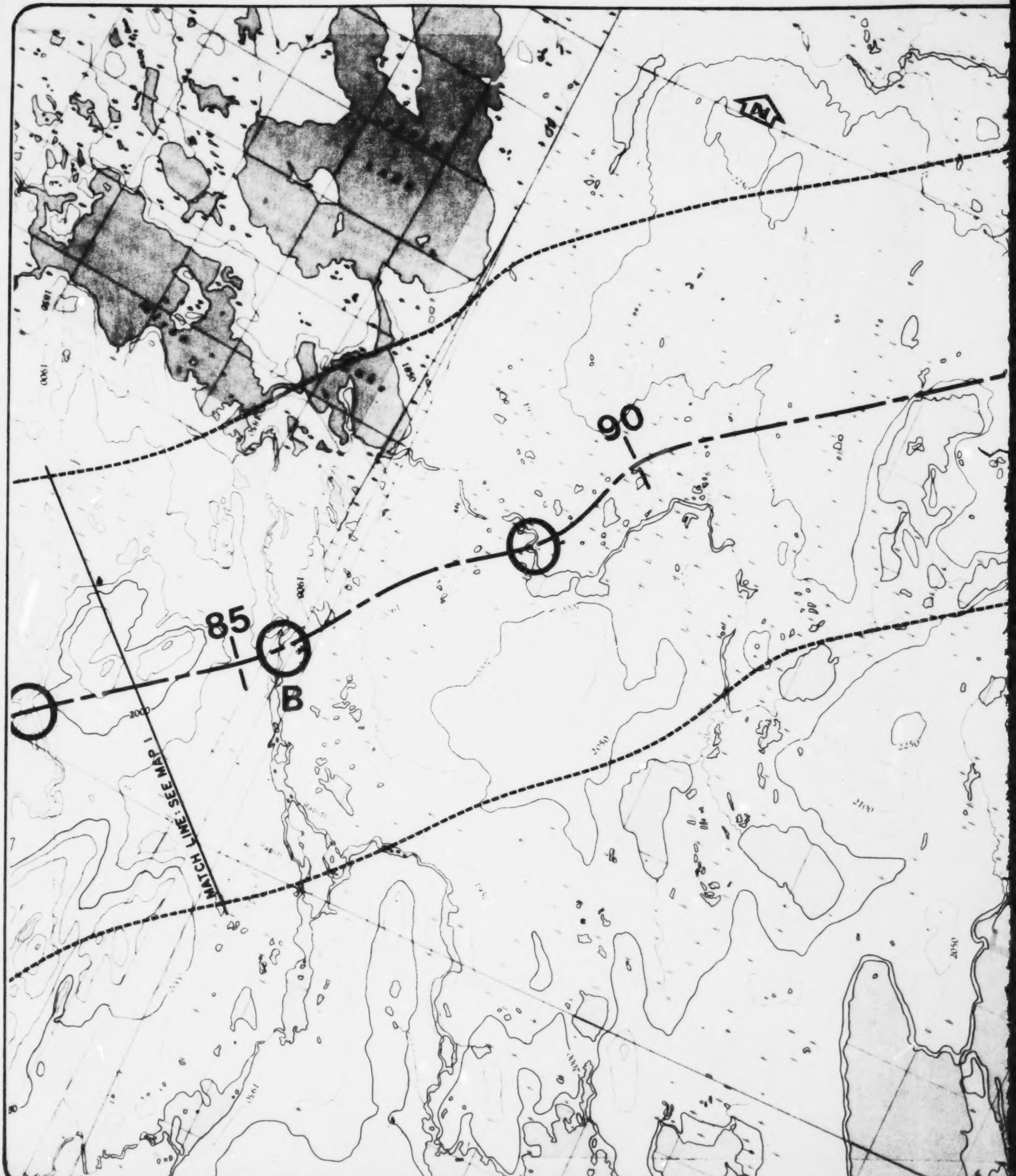
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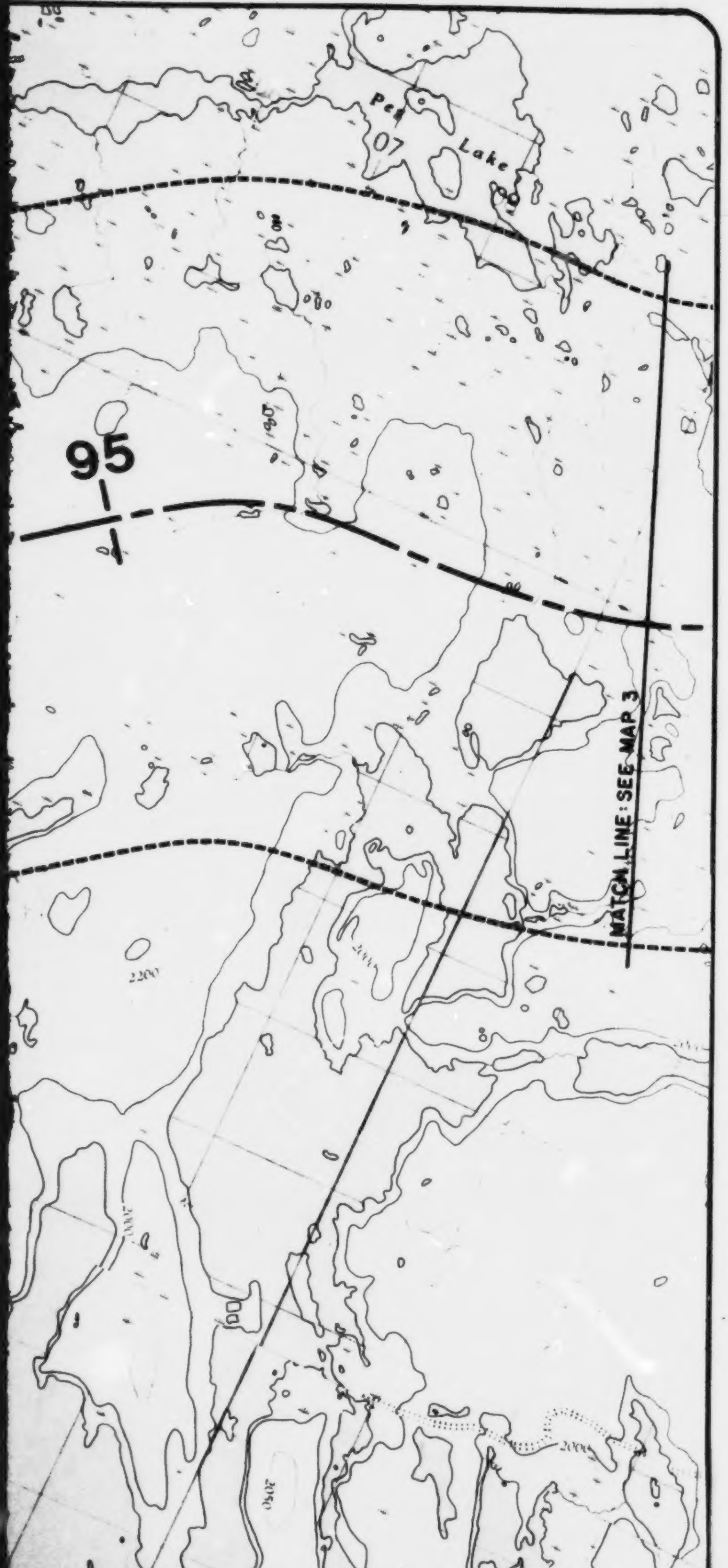
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ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 2

SCALE 1:50,000

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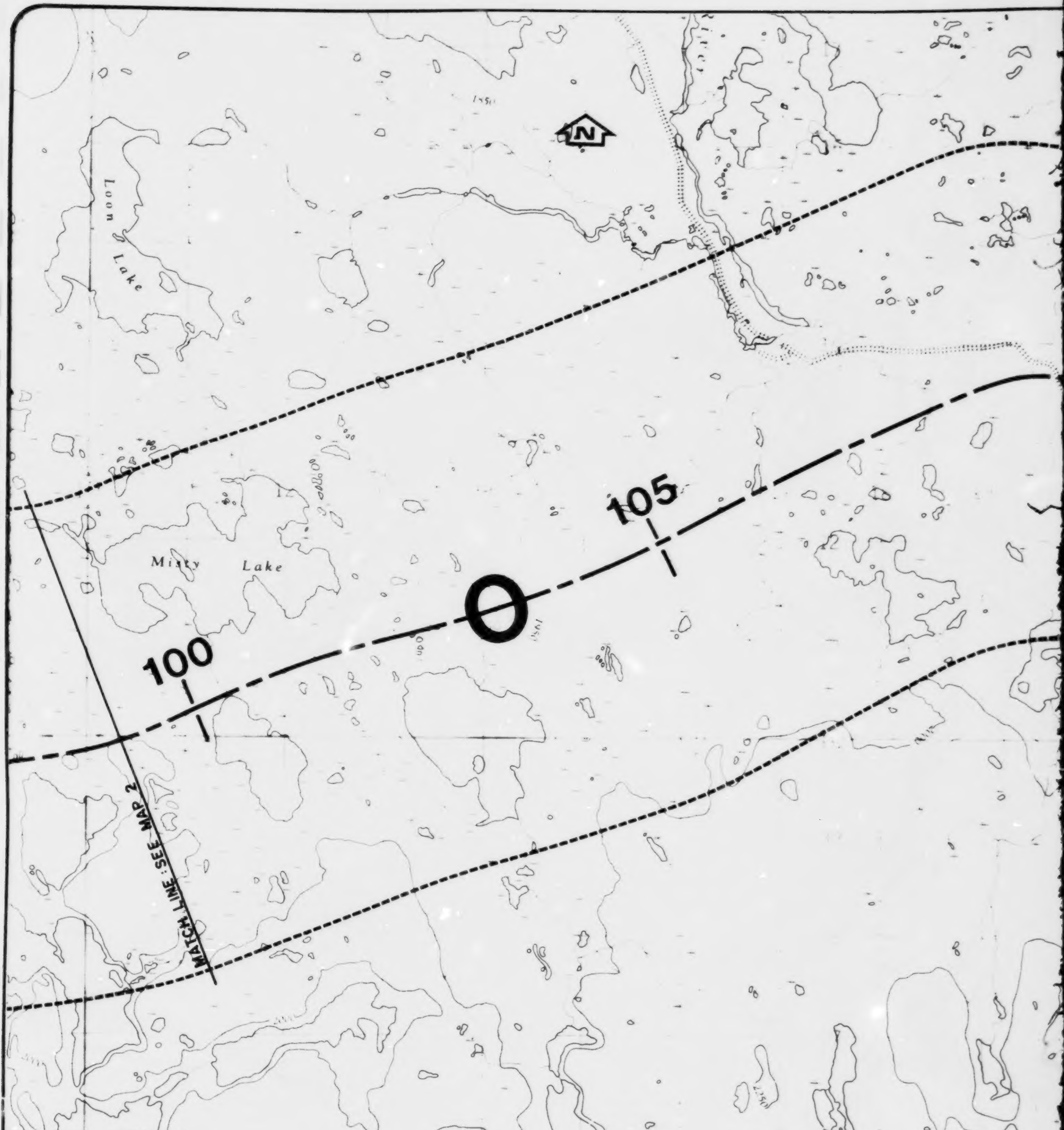
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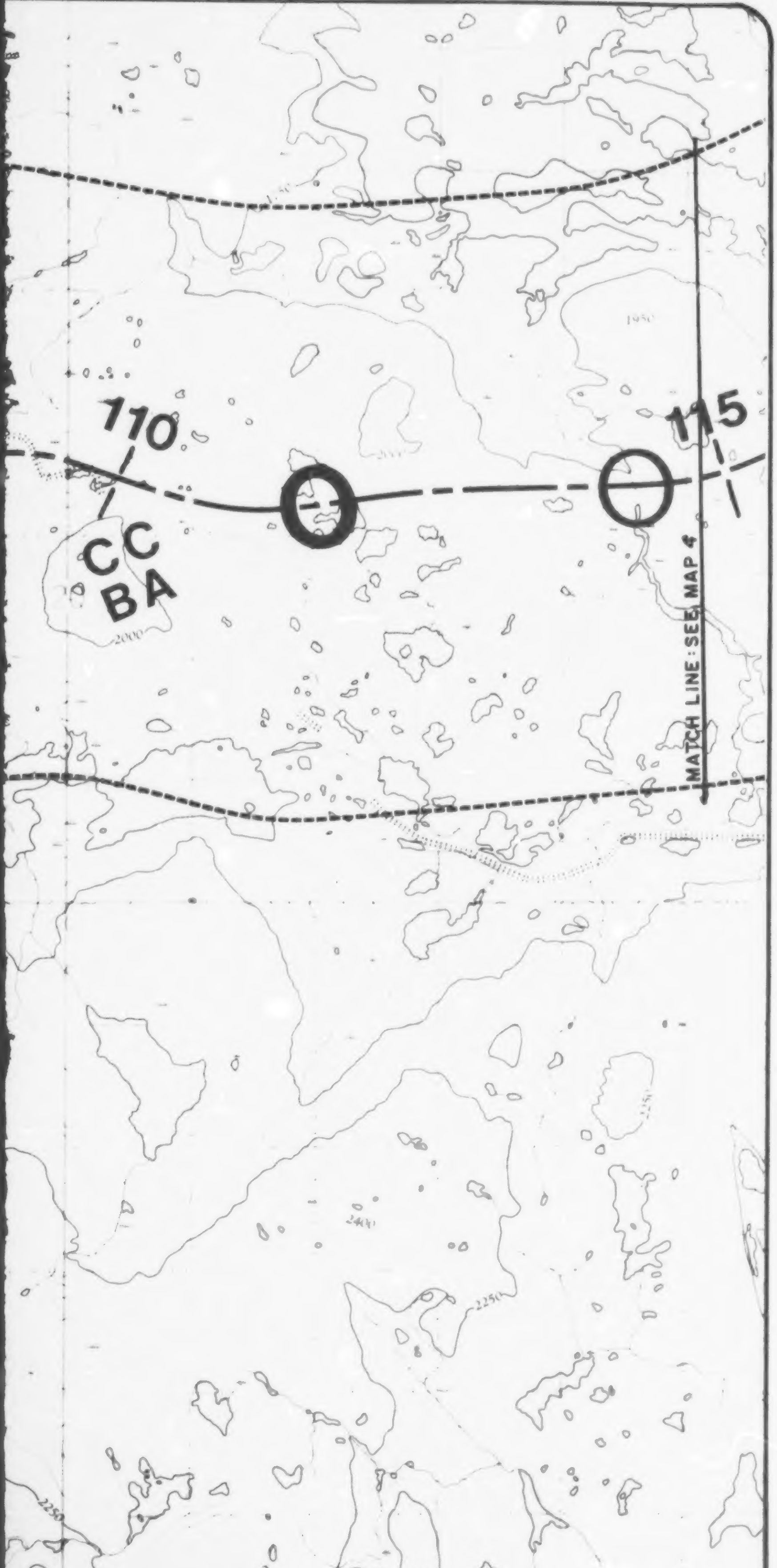
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ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
KILOMETRES FROM WABUSH

MAP 3

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DATE: 1986/02

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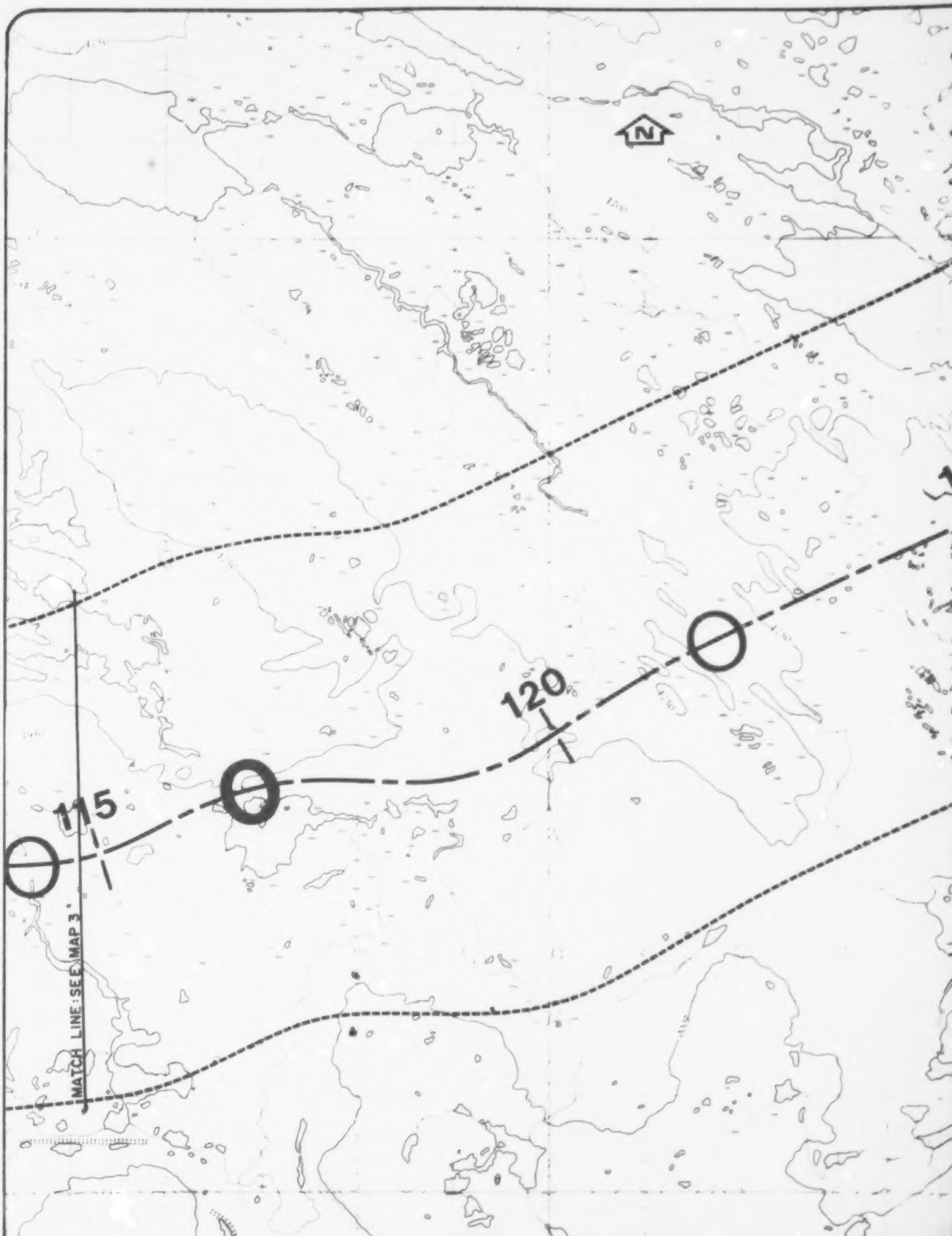
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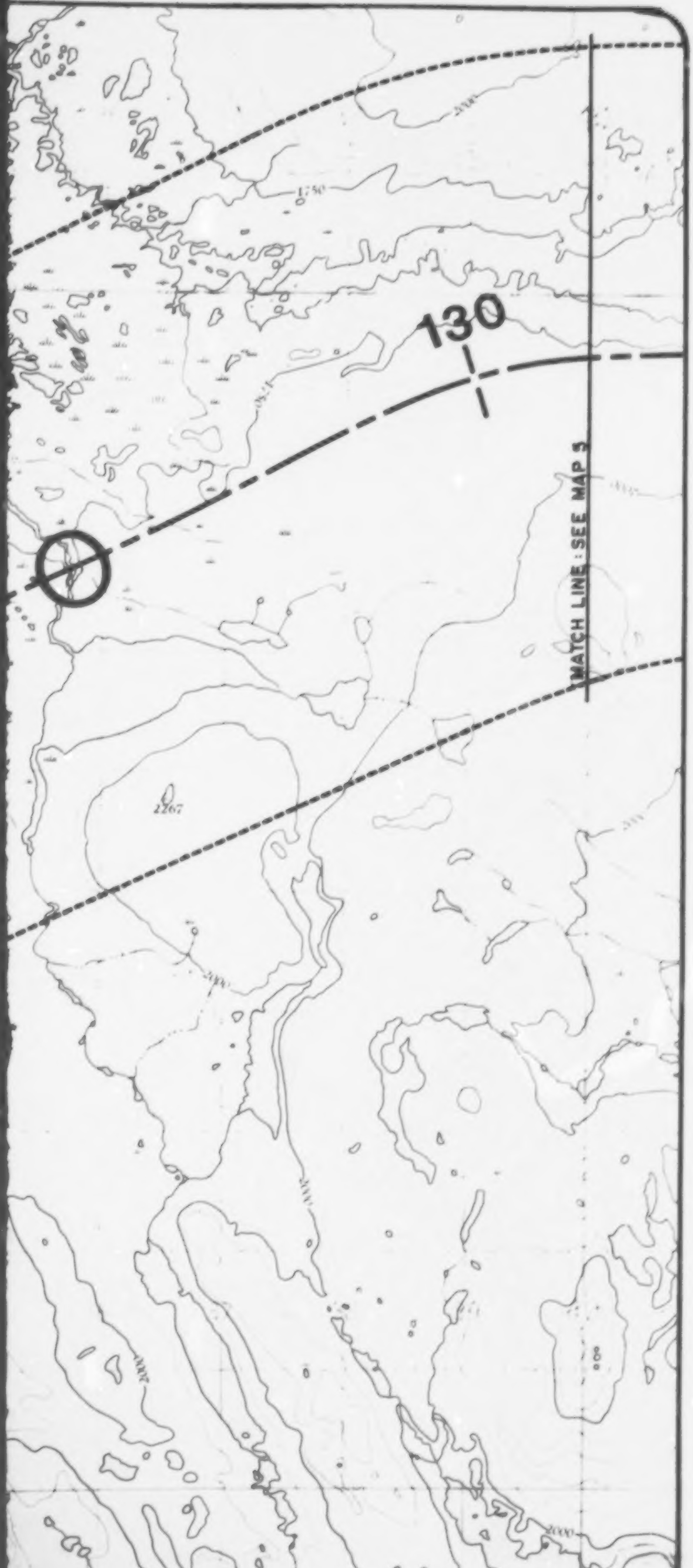

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ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
KILOMETRES FROM WABUSH

MAP 4

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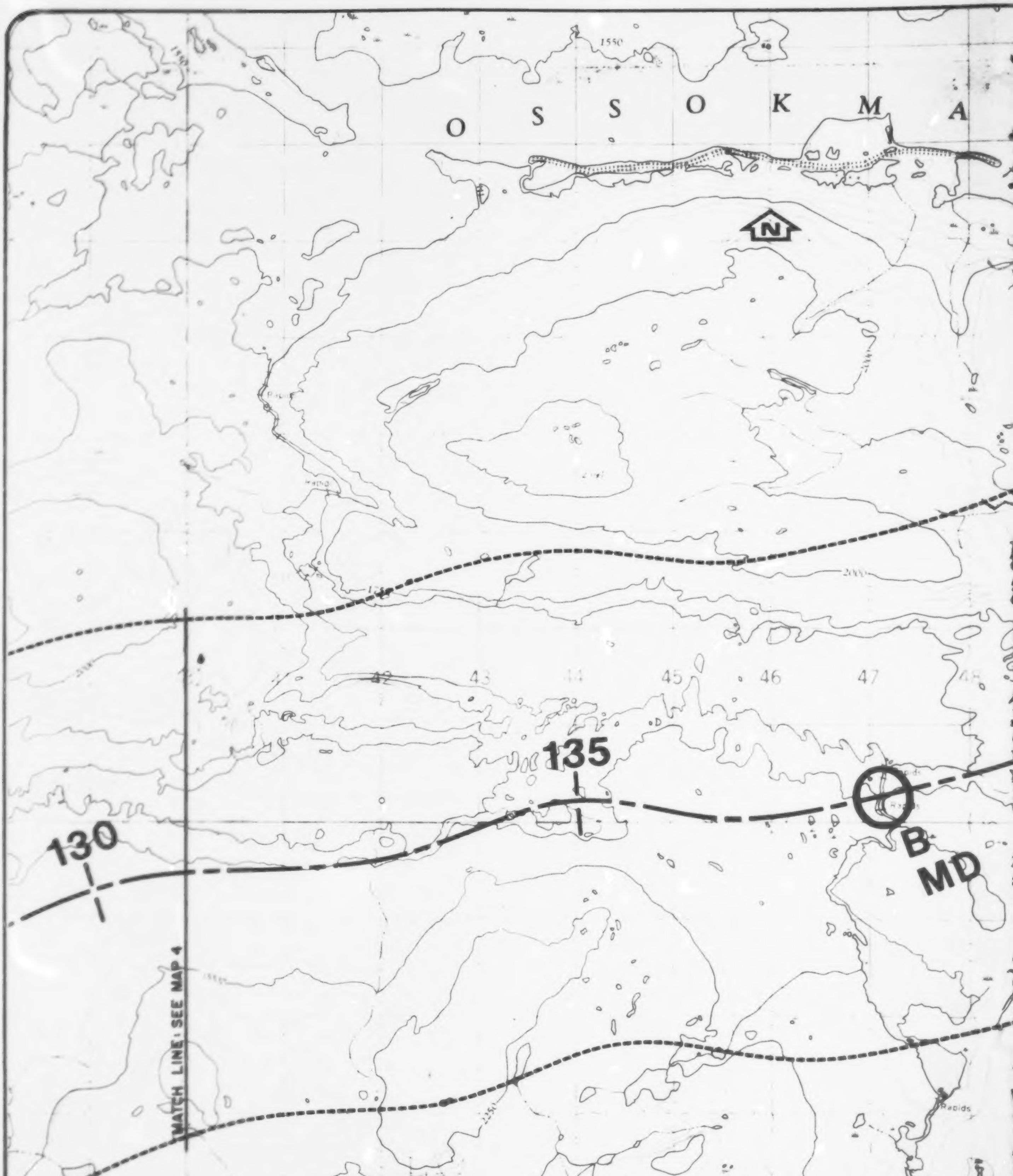
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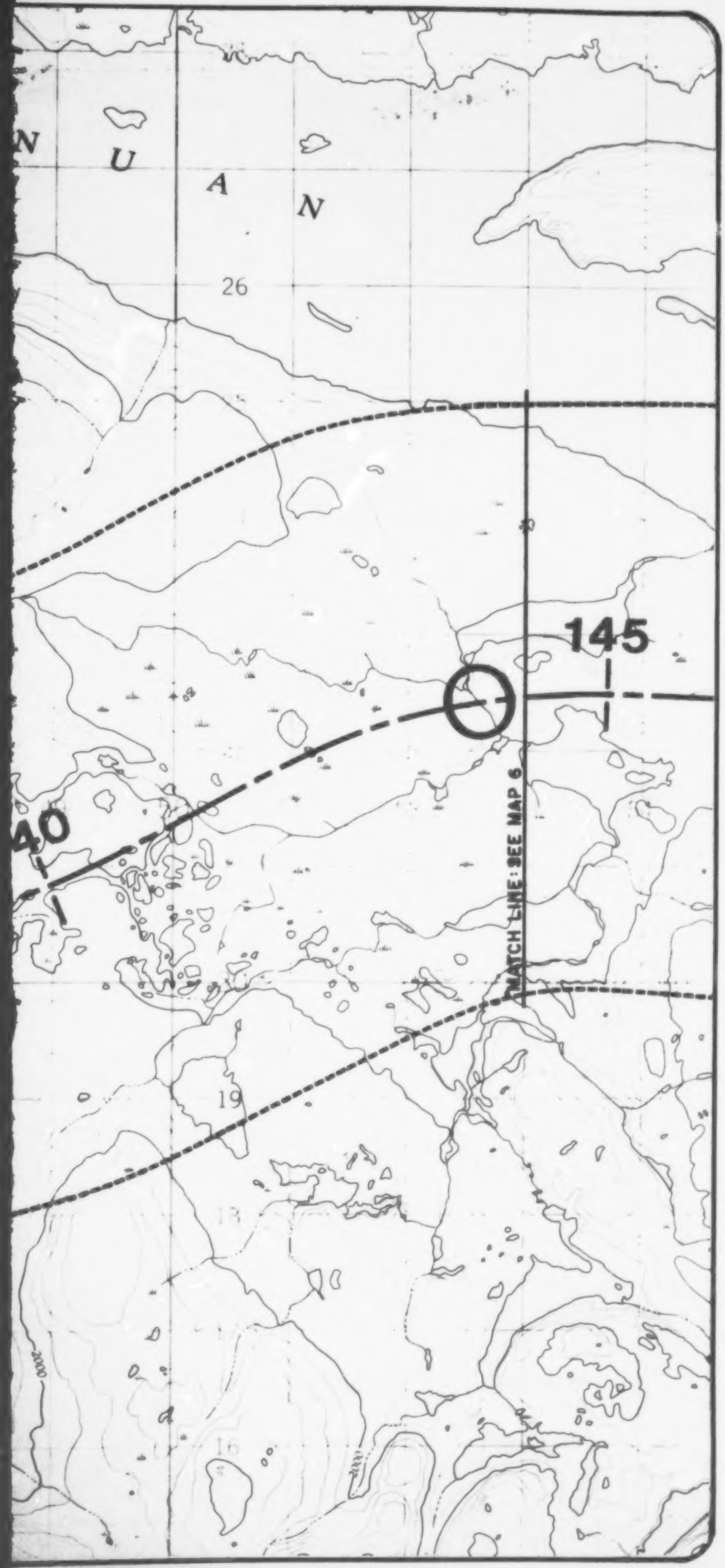
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ROSS BAY JUNCTION-CHURCHILL FALLS
TOTE ROAD
ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 5

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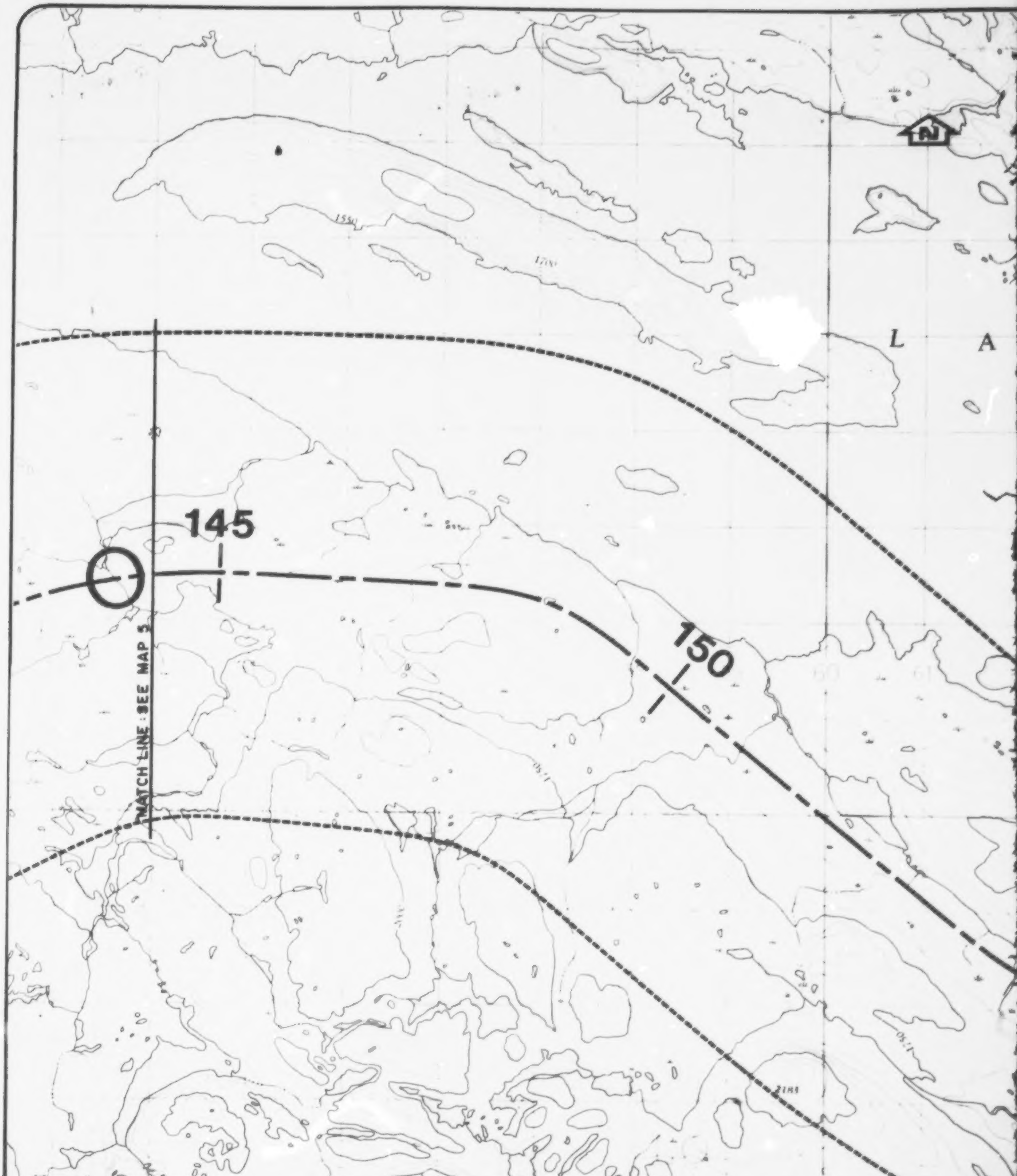
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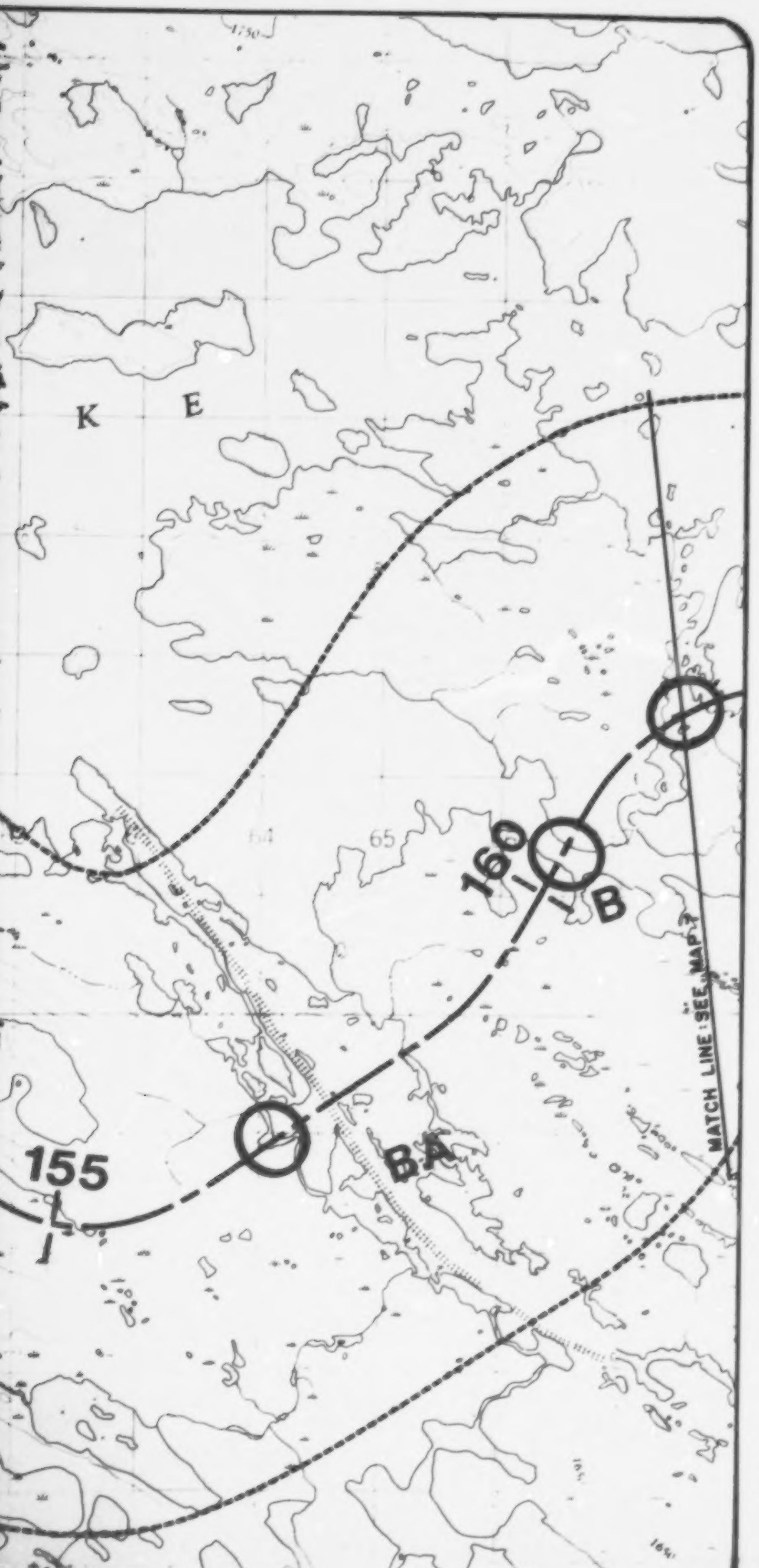
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B
155
BA
MATCH LINE: SEE MAP 7

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

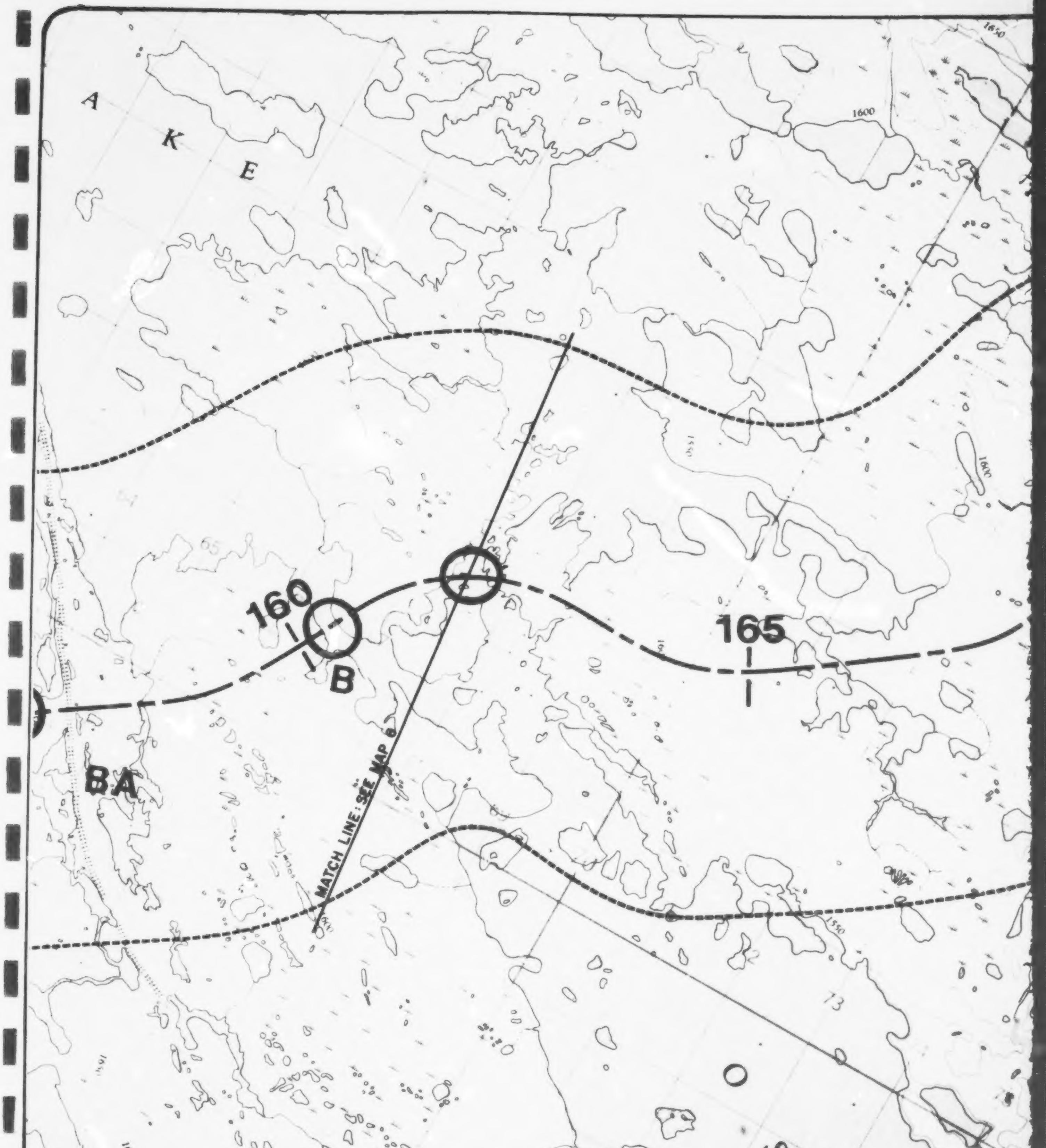
MAP 6

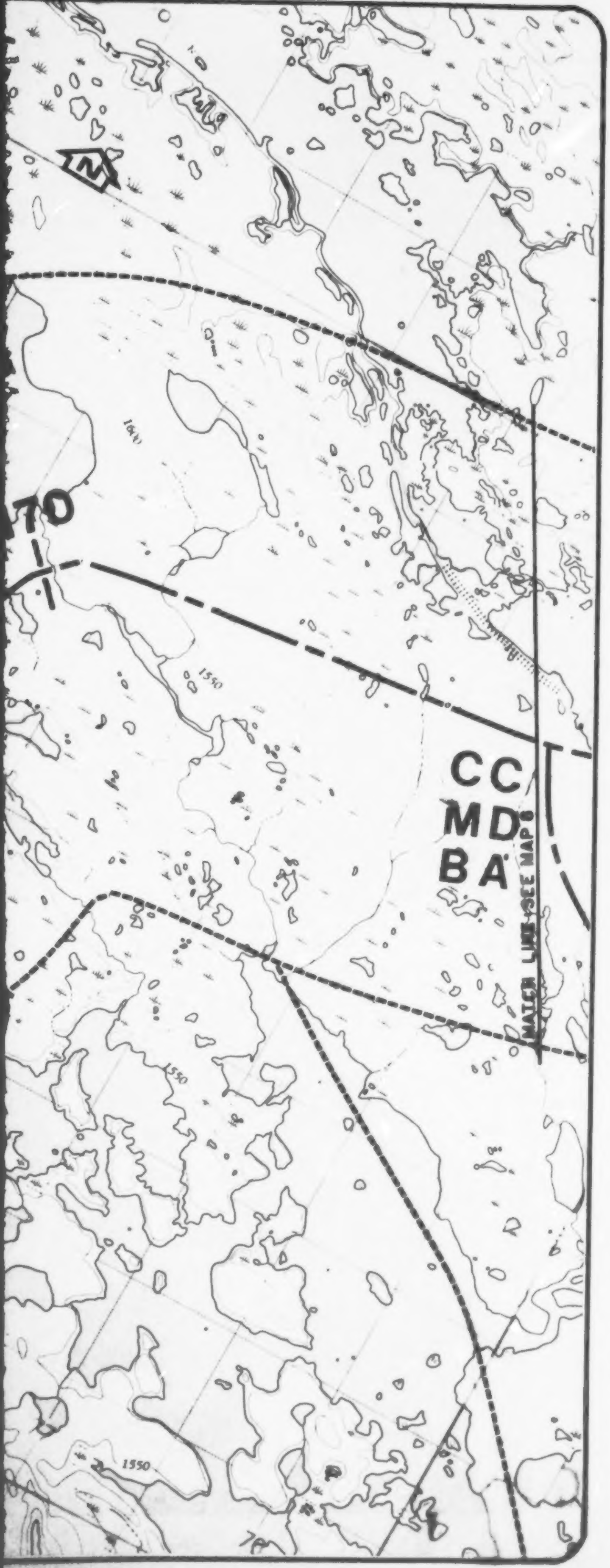
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT DeLCan TRANSPORTATION


A K E
1650
1600
160
B
165
BA
MATCH LINE: SEE MAP 6
1550
1600
65
73
O
S
S


N
170
CC
MD
BA
WATER LINE-SEE MAP 8
1550
1550
1550
1600

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

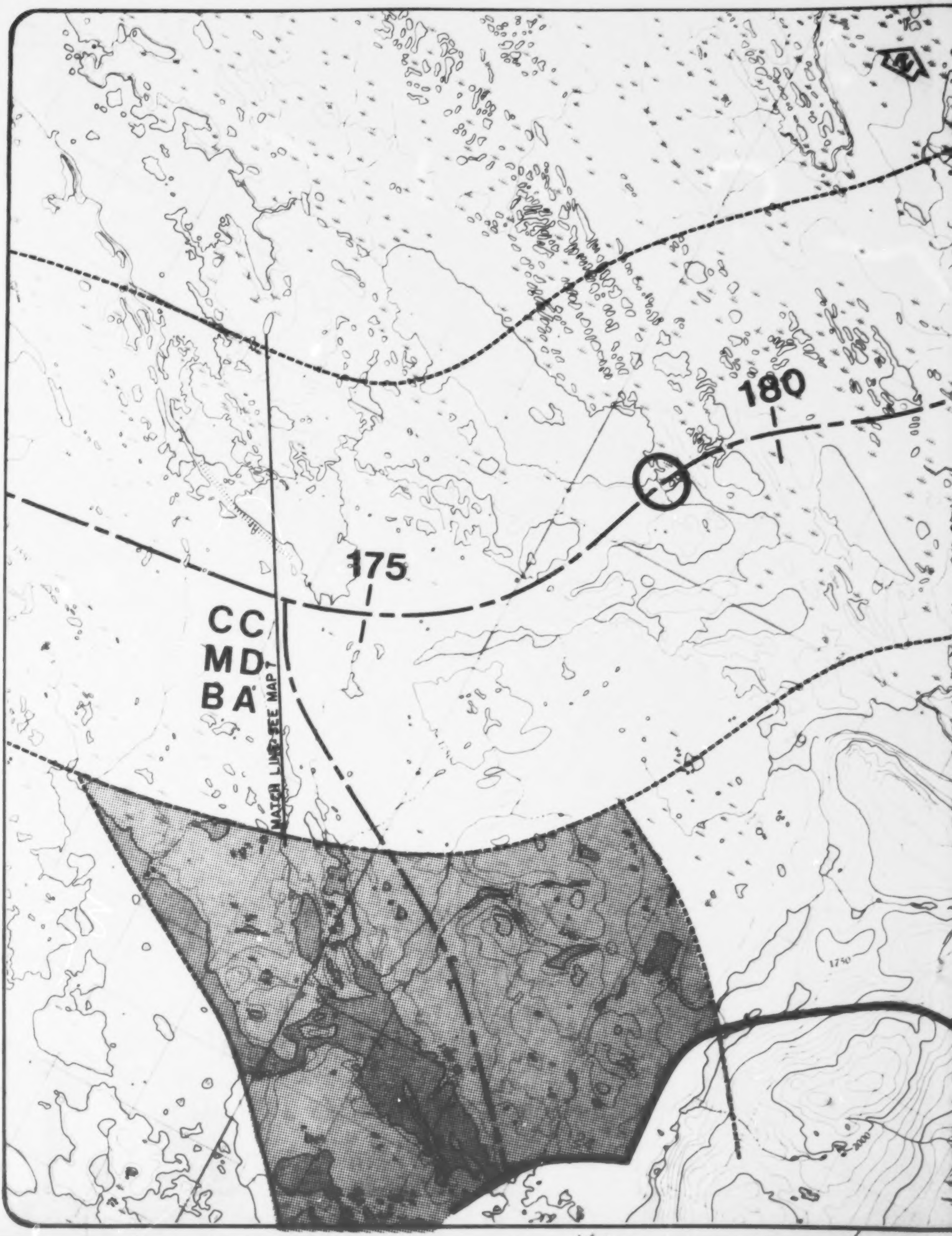
MAP 7

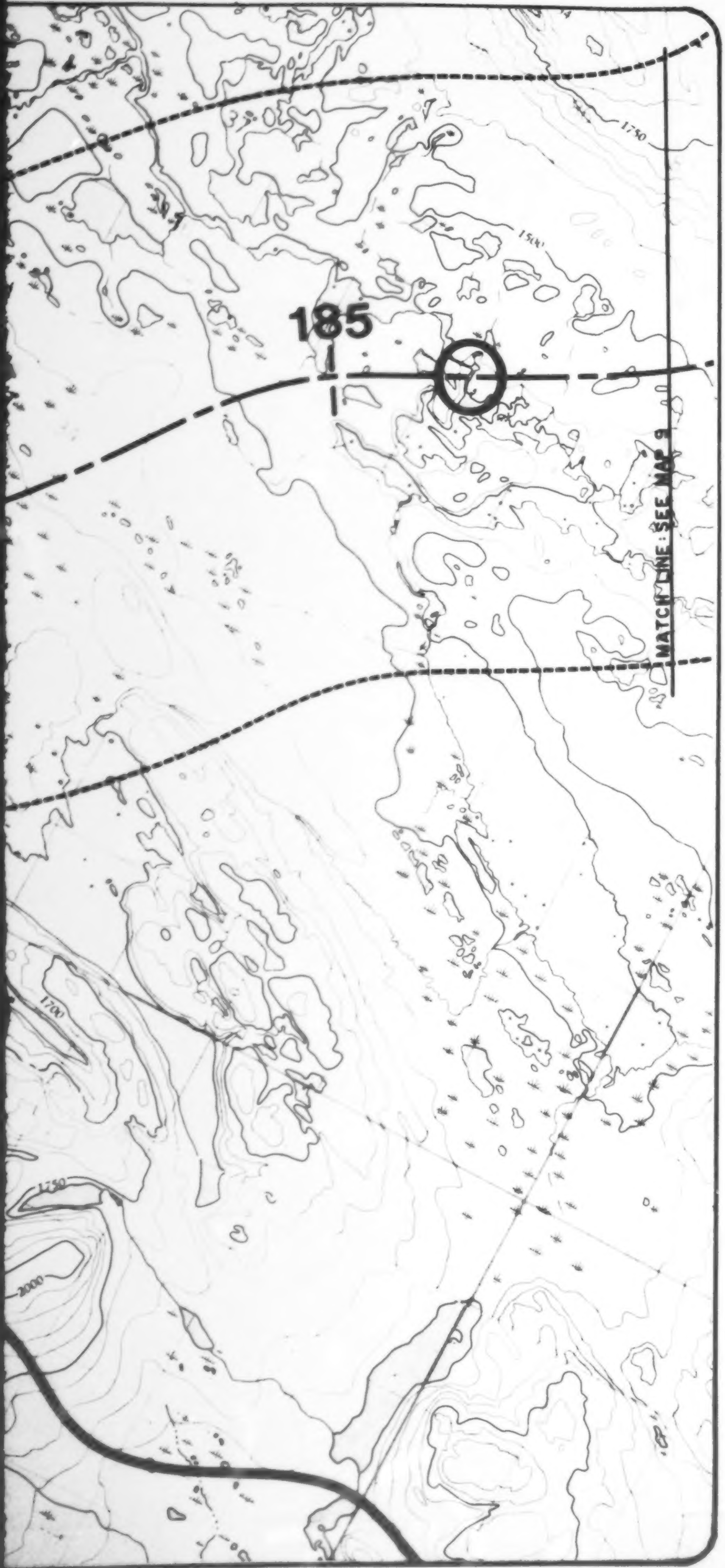
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: DeLCan TRANSPORTATION


180
175
CC
MD
BA
MATCH LINE SEE MAP
1750
2000


1750
1500
185
MATCH LINE: SEE MAP 9
1700
1750
2000

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
▨	ALTERNATE ROUTE

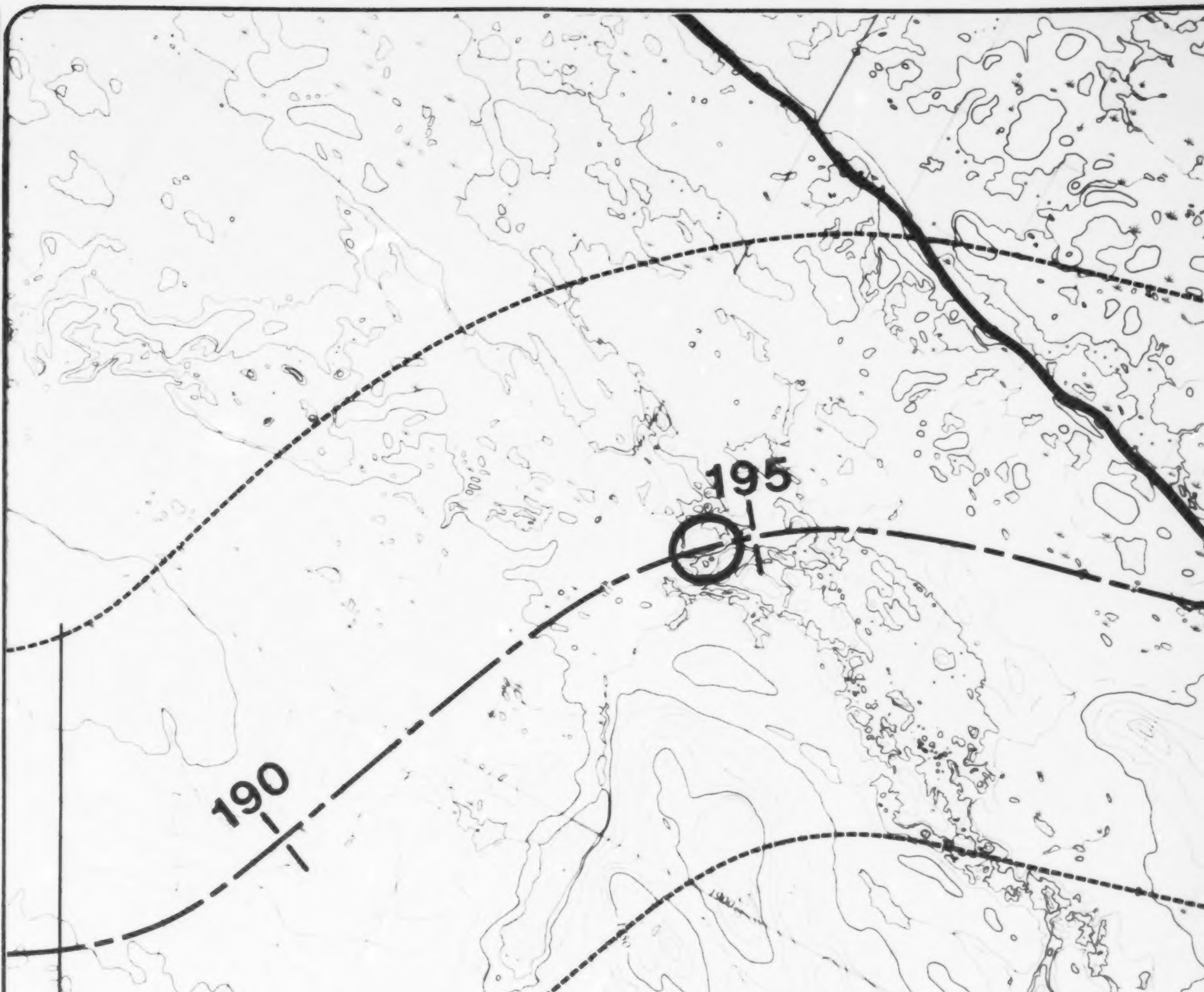
MAP 8

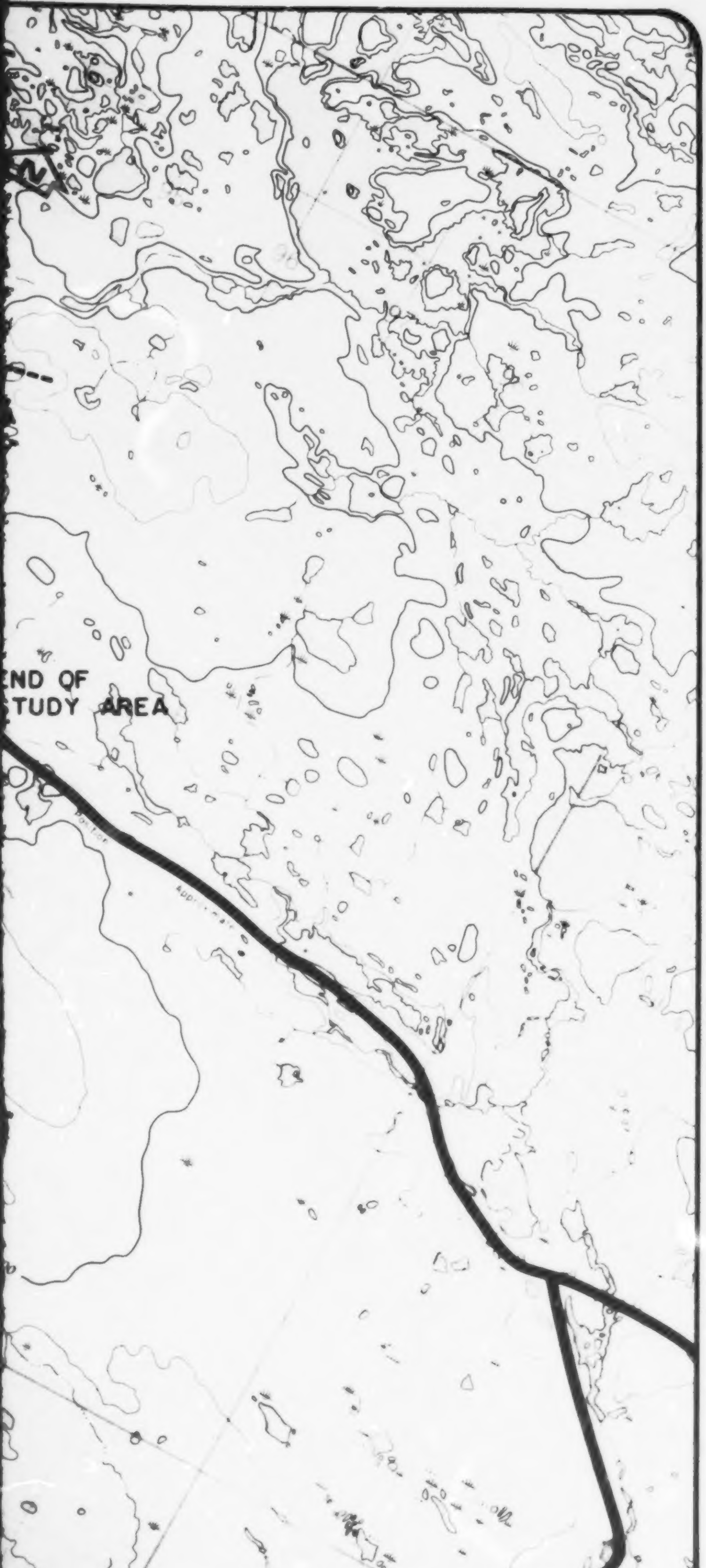
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT DeLCan TRANSPORTATION


195
190
MATCH LINE: SEE MAP 8
VALLEY



ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP

BA BORROW AREA

MD MAINTENANCE DEPOT

○ RIVER CROSSING

B BRIDGE

KILOMETRES FROM WABUSH

MAP 9

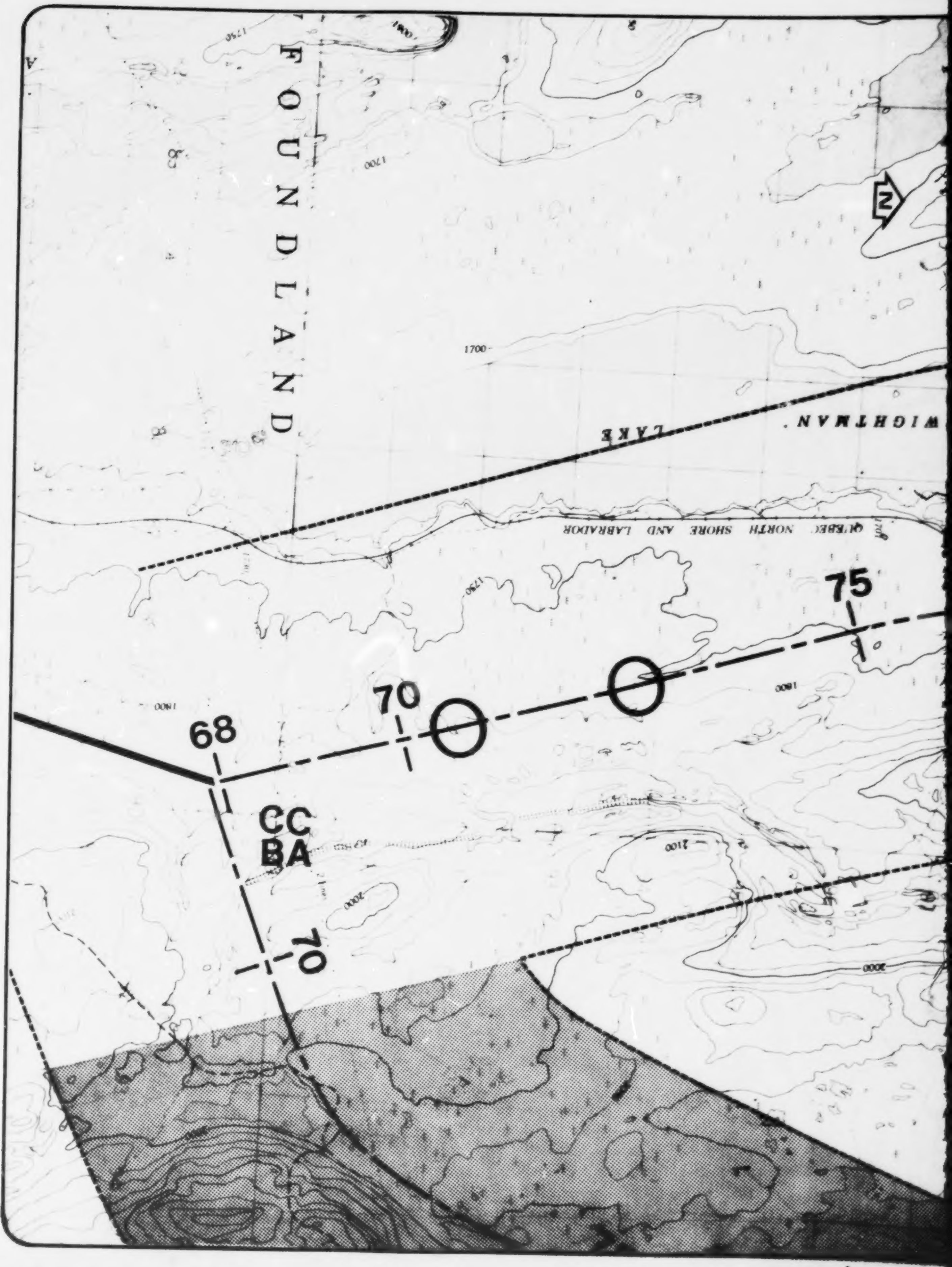
SCALE 1:50,000

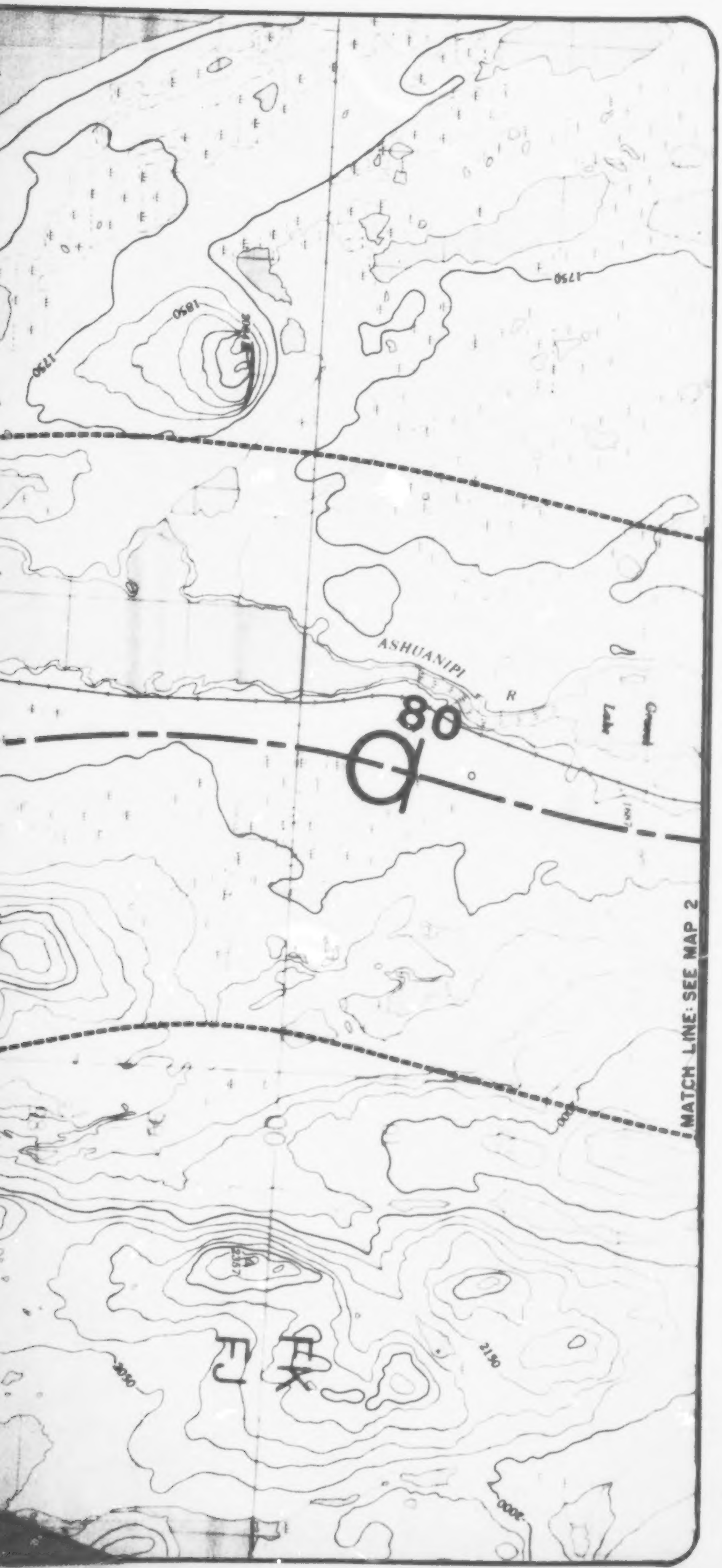
1000 500 0 1000 METRES

DATE: 1986 /02

CONSULTANT: DeLCan

TRANSPORTATION


FOUNDLAND
1700
WIGHTMAN.
LAKE
QUEBEC NORTH SHORE AND LABRADOR
1750
1800
75
70
68
CC
BA
70
70
2100
2000


1750
1850
1790
ASHUANIPI R
80
Lake
MATCH LINE: SEE MAP 2
2357
2130
2030
2000

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
# KILOMETRES FROM WABUSH
▨ PROPOSED ROUTE

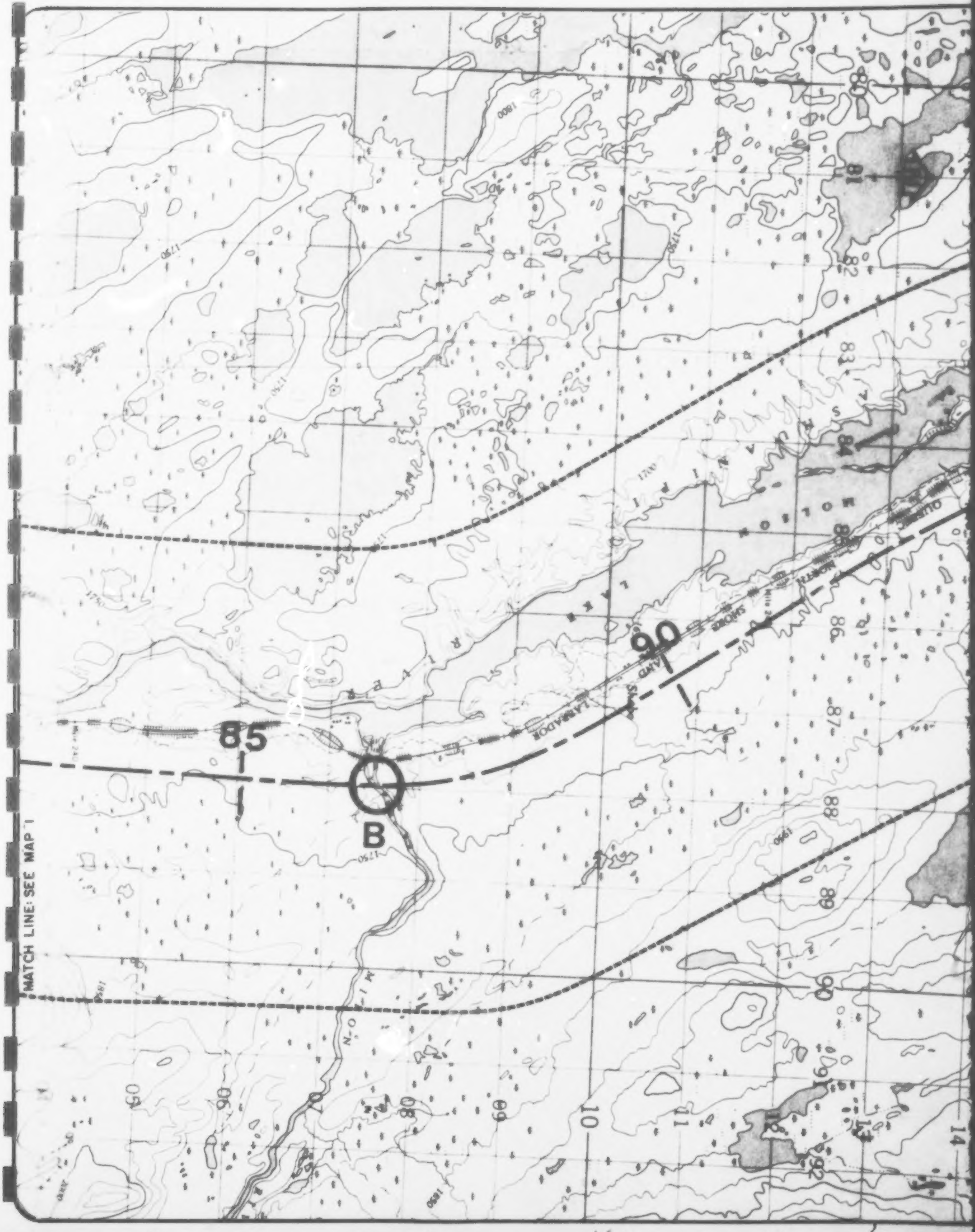
MAP 1

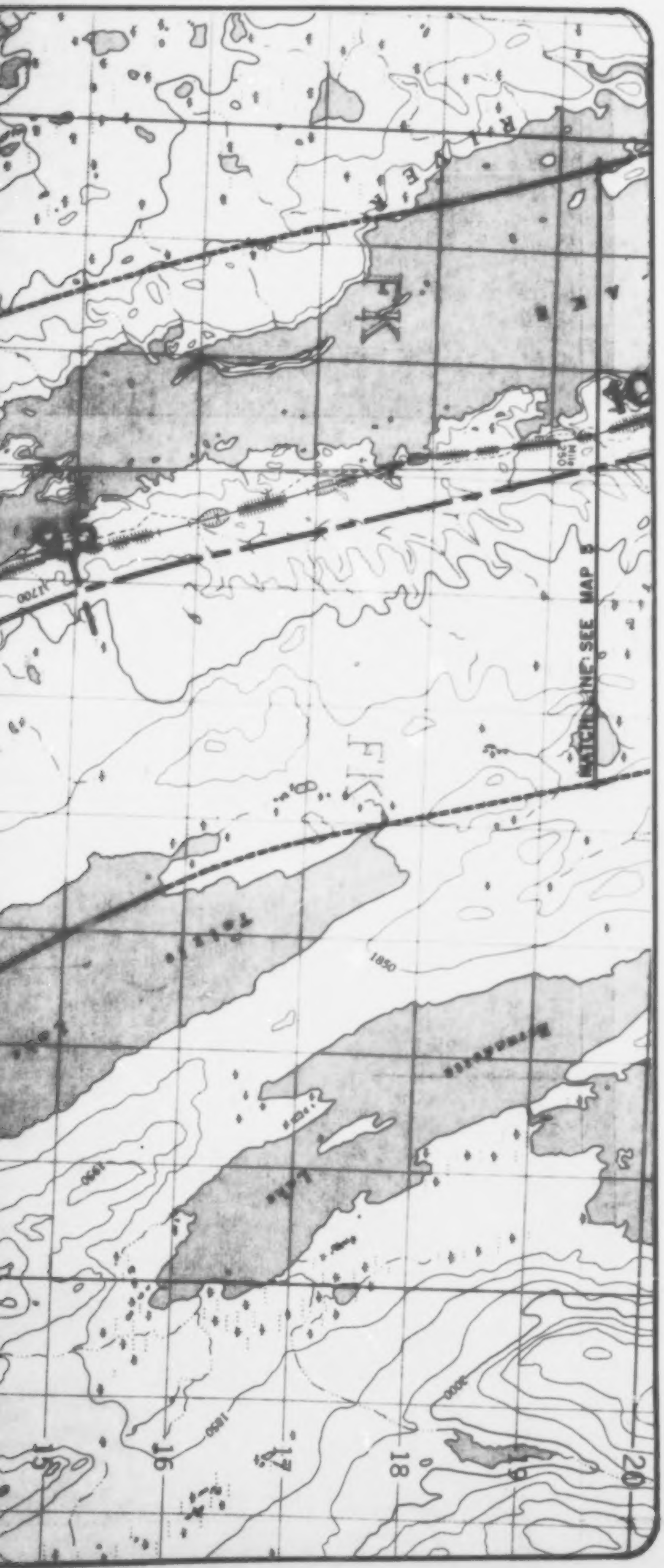
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT **DeLCan TRANSPORTATION**


MATCH LINE: SEE MAP 1
85
90
B
80
81
82
83
84
86
87
88
89
90
91
92
LAKE
QUEBEC NORTH SHORE AND LABRADOR
1700
1750
1800
1950
05
06
07
08
09
10
11
12
13
14



MATCH LINE: SEE MAP 5
Mile 250
10
1700
1850
2000
15
16
17
18
19
20

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 2

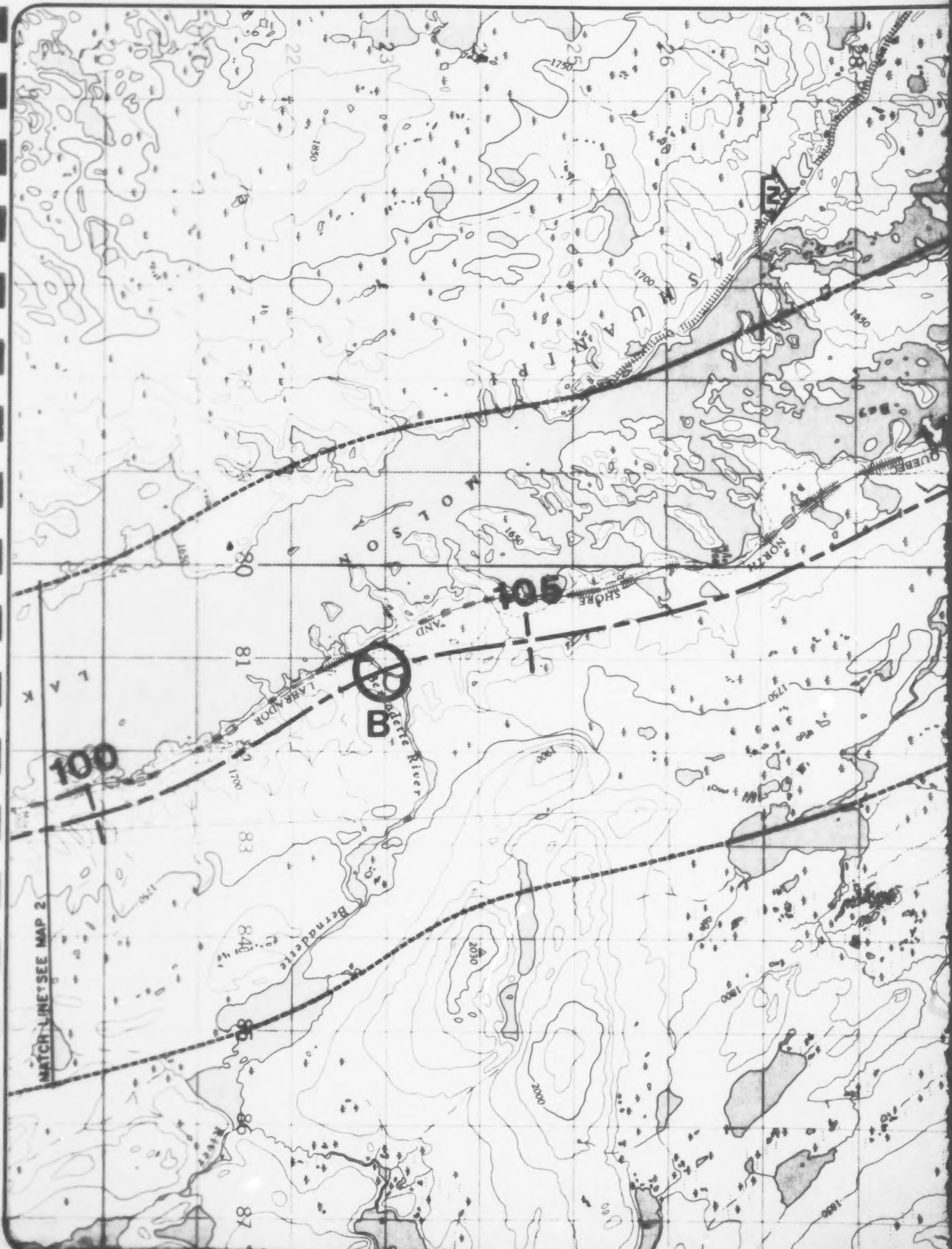
SCALE 1:50,000

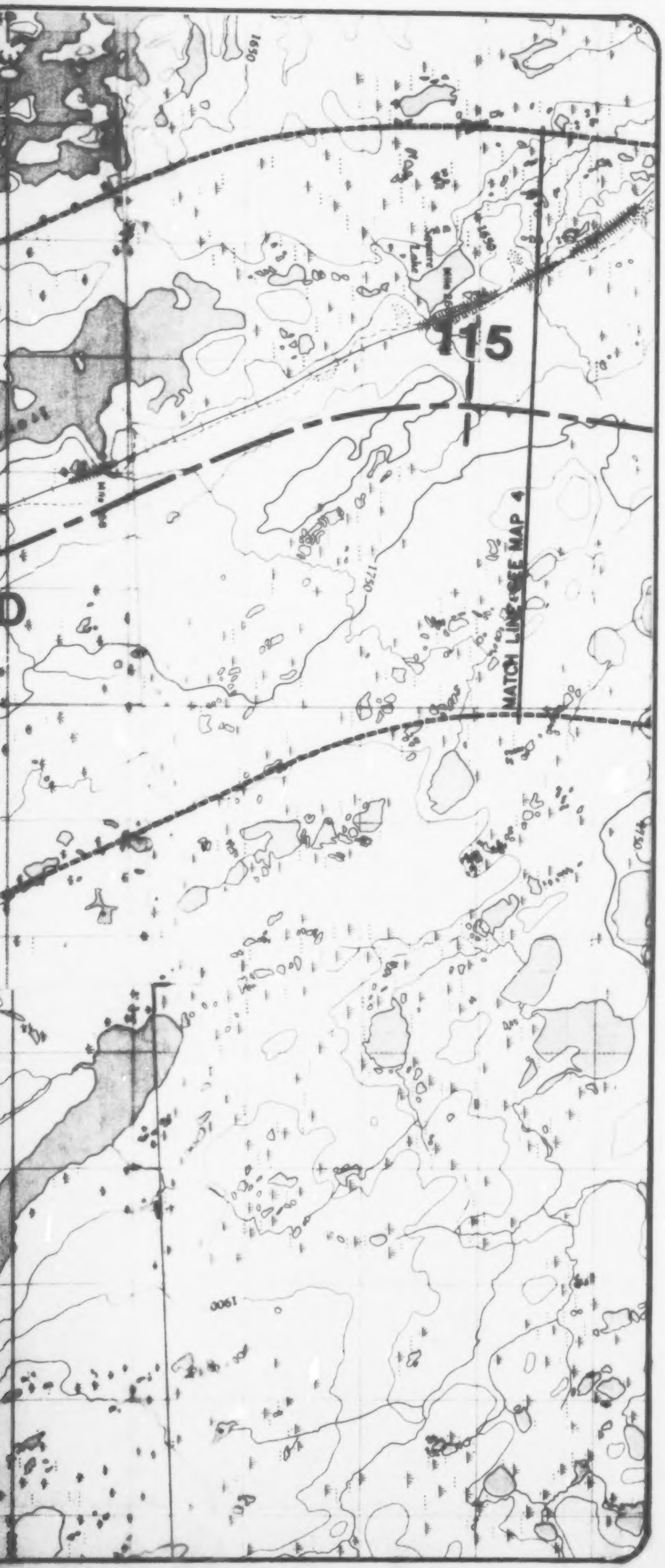
1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: DeLCan

TRANSPORTATION


22
23
25
26
27
28
1750
75
1850
1700
ASHUANIPI
1650
Bay
QUEBEC
NORTH
SHORE
AND
LABRADOR
105
80
81
B
Bernadette River
100
1700
83
1750
84
Bernadette
85
86
87
2030
2000
1900
1800
LAK
MATCH LINE-SEE MAP 2


115
MATCH LINE SEE MAP 4
1650
1750
1900

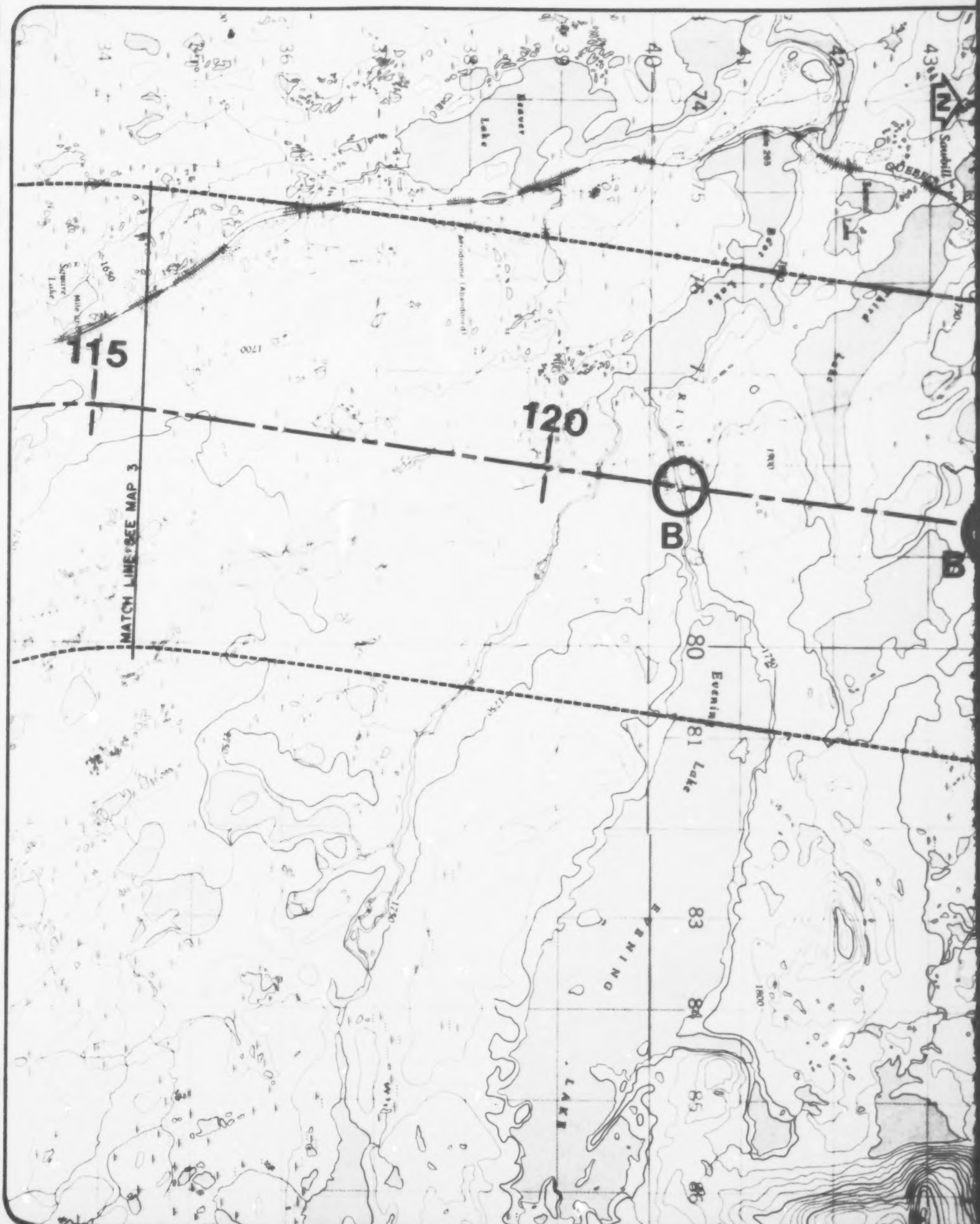
ROSS BAY JUNCTION-CHURCHILL FALLS
TOTE ROAD
ENVIRONMENTAL IMPACT ASSESSMENT

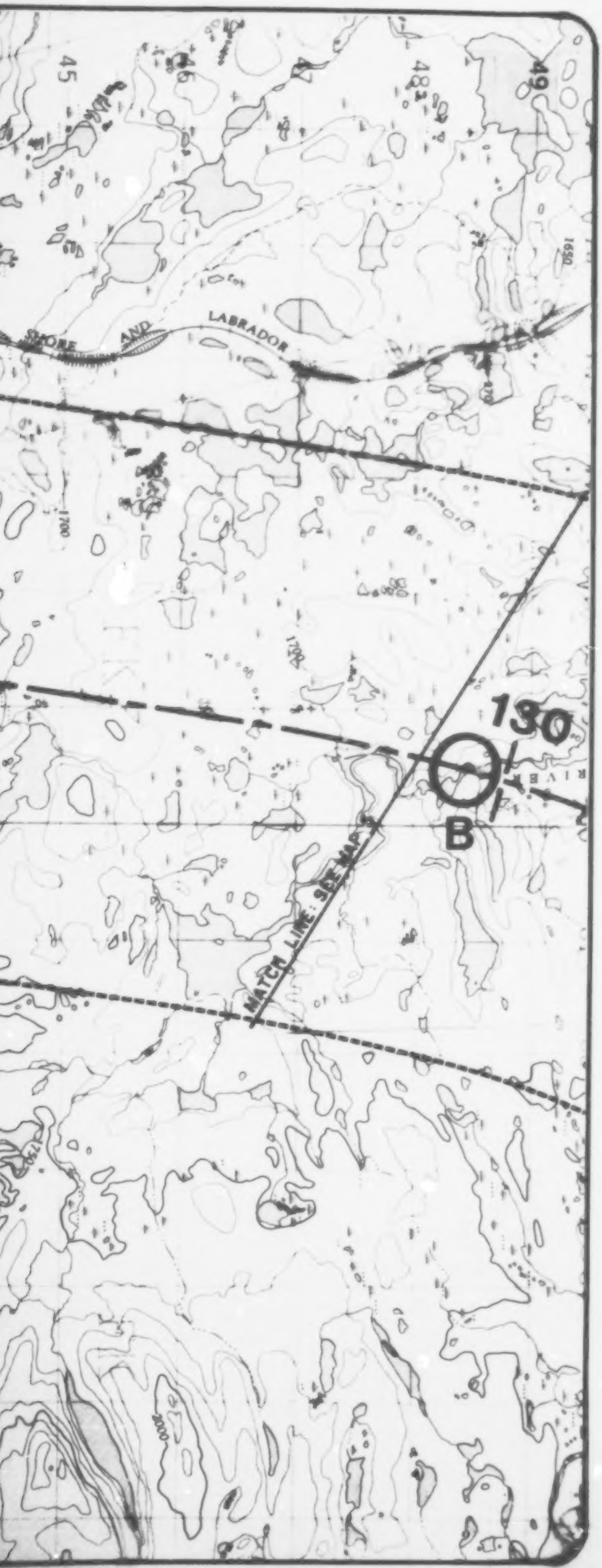
ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 3

SCALE 1:50,000
1000 500 0 1000 METRES
DATE: 1986/02
CONSULTANT: DeLCan TRANSPORTATION


34
36
37
38
39
40
41
42
43
N
74
75
76
77
80
81
83
84
85
86
Beaver Lake
Square Lake
1650
1700
115
120
MATCH LINE SEE MAP 3
RIVER
B
B
1800
1780
Evening Lake
EVENING LAKE


45
46
47
48
49
1650
SHORE AND LABRADOR
1700
1700
130
RIVER
B
MATCH LINE: SEE MAP 3
2000

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 4

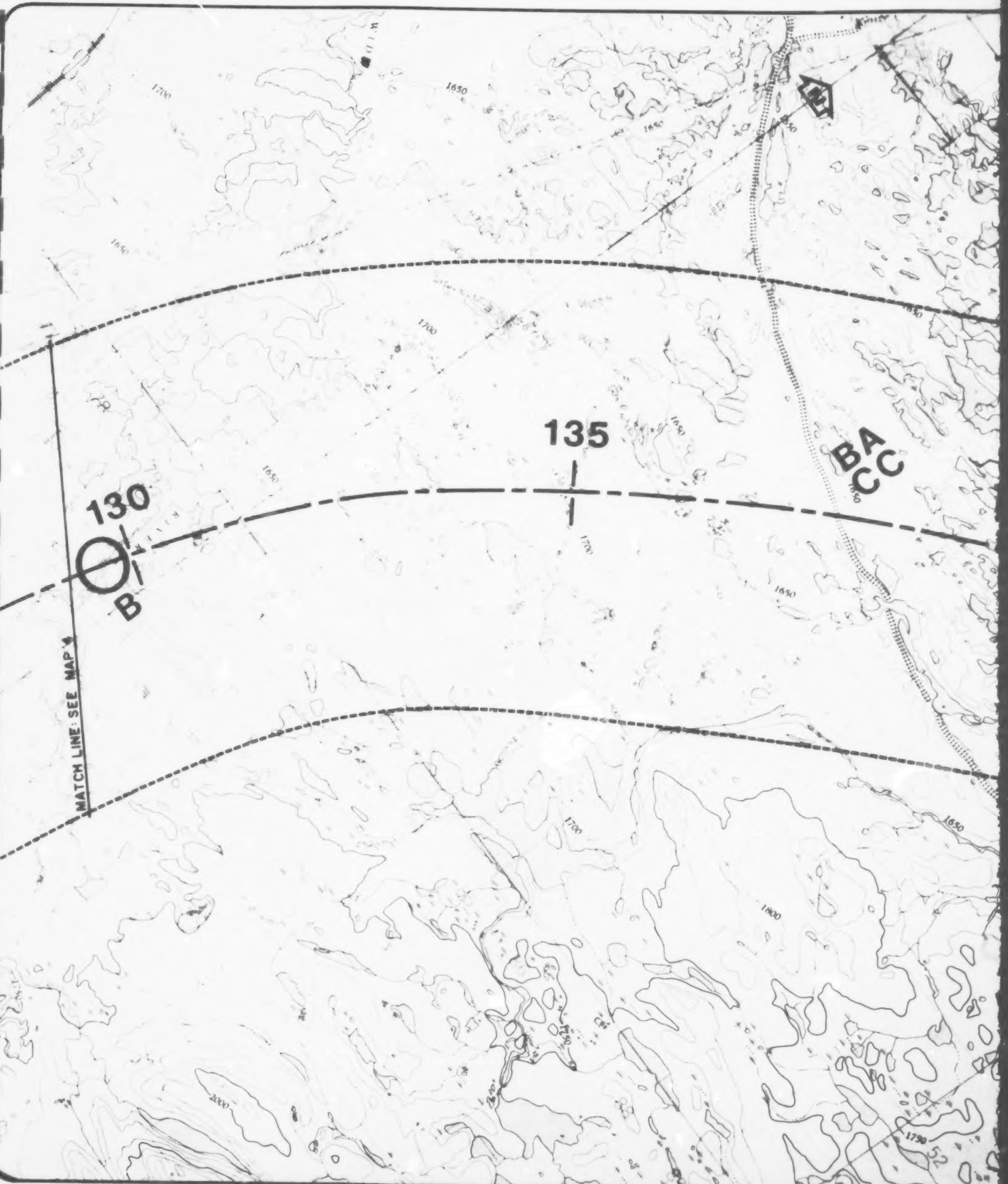
SCALE 1:50,000

1000 500 0 1000 METRES

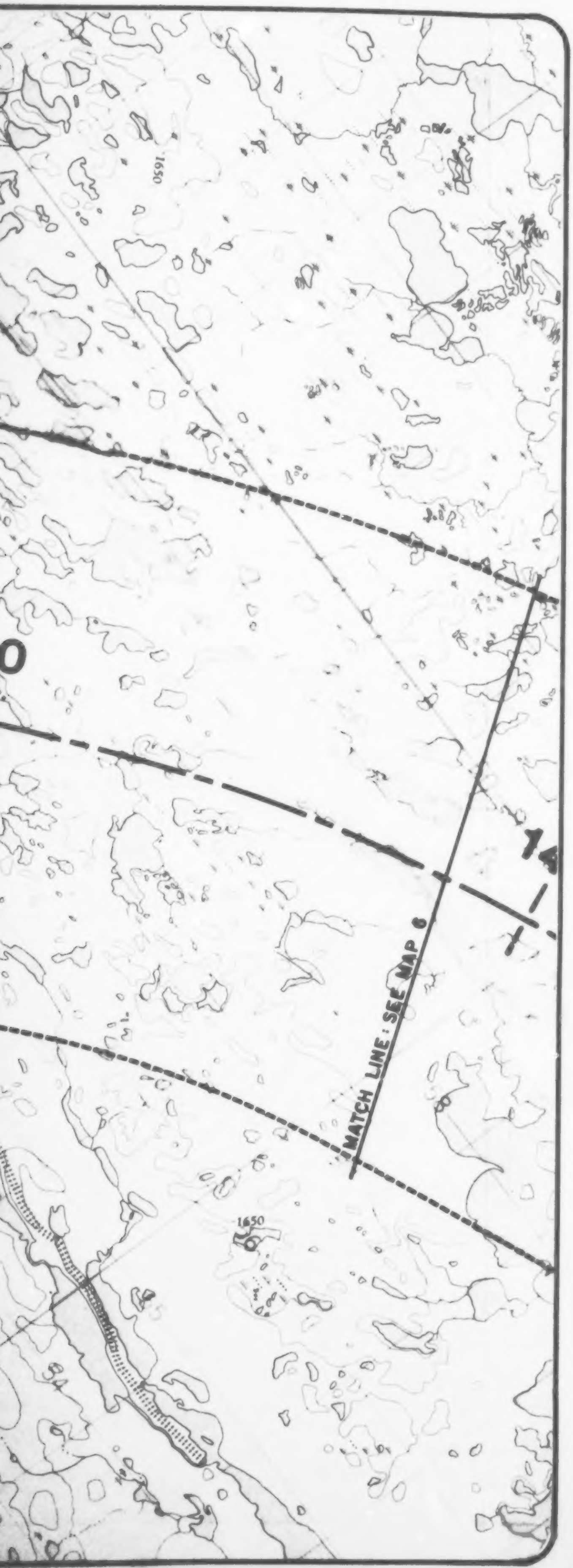
DATE: 1986/02

CONSULTANT: DeLCan

TRANSPORTATION



130
B
135
BA
CC
MATCH LINE: SEE MAP 4
1700
1650
1800
1750
2000


1650
0
14
MATCH LINE: SEE MAP 6
1650

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

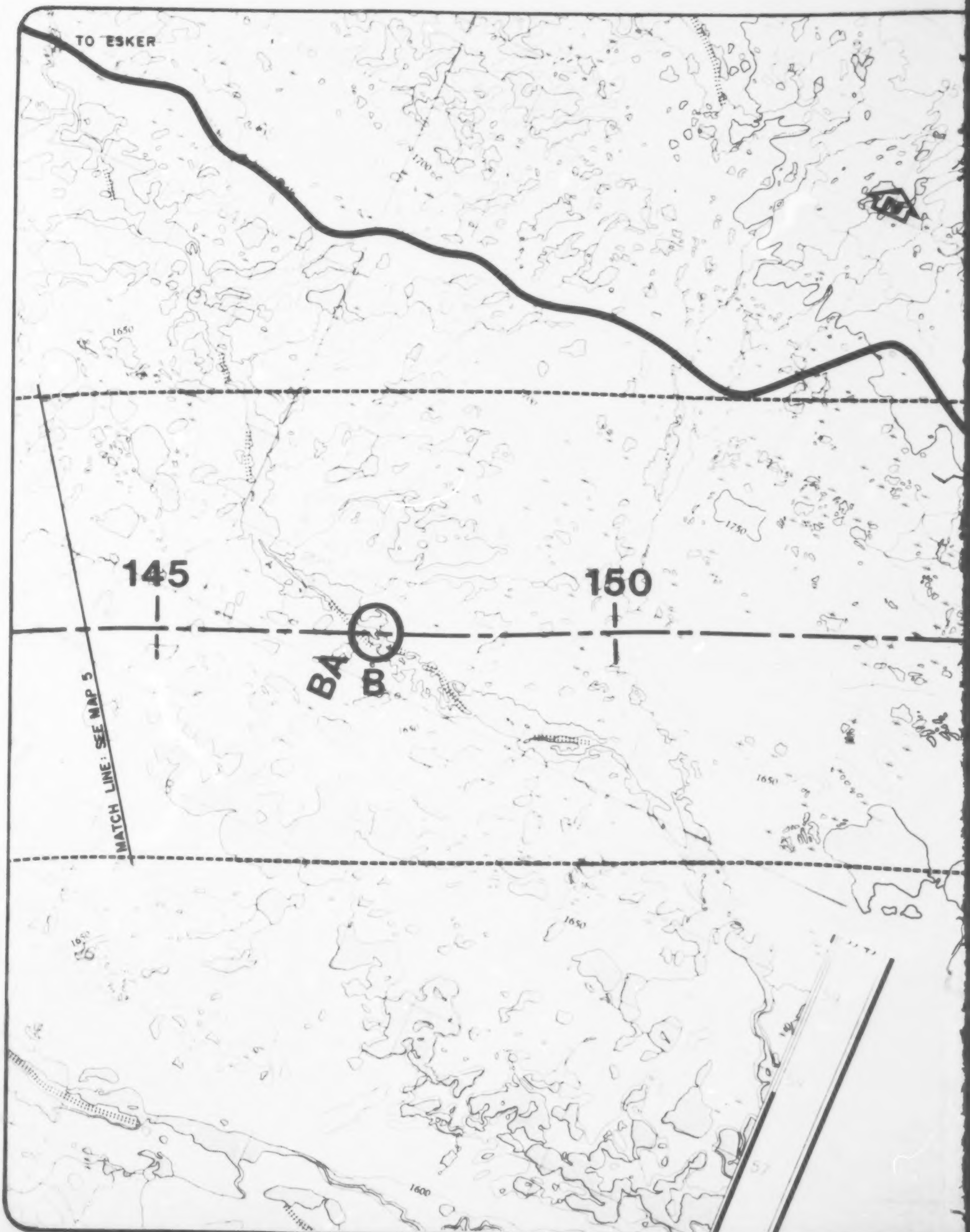
MAP 5

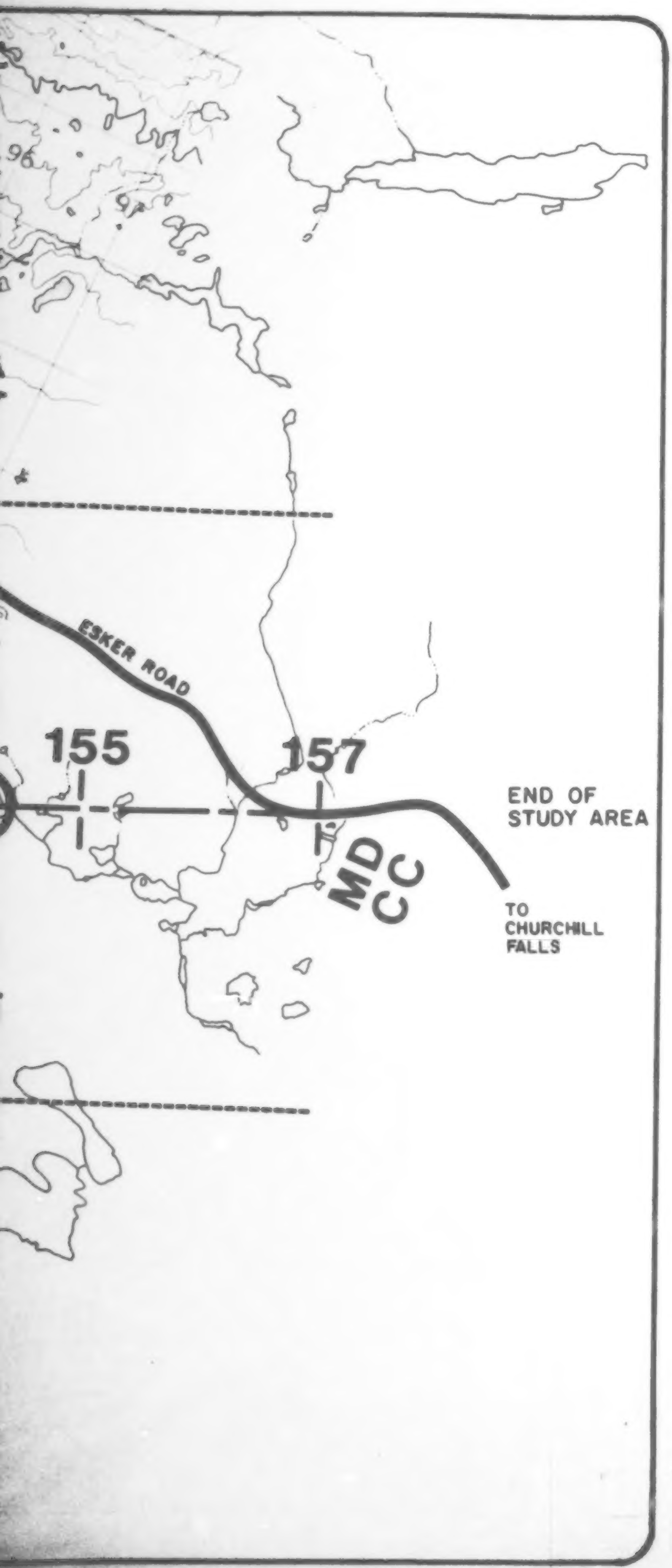
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986 /02

CONSULTANT: DeLCan TRANSPORTATION


TO ESKER
1700
1650
1750
145
150
BA
B
MATCH LINE: SEE MAP 5
1650
1650
1650
1650
1600


96
97
ESKER ROAD
155
157
MD
CC
END OF STUDY AREA
TO CHURCHILL FALLS

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH

MAP 6

SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: DeLCan

TRANSPORTATION

Appendix "D"

SYSTEMS DIAGRAMS COMPLETED
AT JANUARY '86 WORKSHOP

PUBLIC PARTICIPATION

INFORMATION FROM OTHER COMPONENT

From Geol/Soils/Veg.

- Mapping for presentation

From Historic Resources

- sites (?)

From Socio-Economics

- Exist - social structure
  - economic condition
- Future - social structure
  - economic condition

From Tourism, Recreation etc.

- Existing use by resident type i.e., numbers by type
- Future use with road using same breakdown
- Harvest - existing
  - future

From Native Resource Use

- Existing resource use (harvest)
- Future use with new road

From Wildlife

- Existing used wildlife pop and their ranges
- Future changes as result of
  - road placement
  - people

From Aquatic

- Existing aquatic pop. at crossings
- Existing good habitat
- Future changes as result of road and people.

From Engineering

- Route location (study area)
- Road cross-section
- Type of structures
- Crossing sites
- Scheduling
- Employ. needs
- Traffic

PUBLIC PARTICIPATION

- Perceived concerns
- Public attitudes
- Questions for other experts
- Inform public
- Act as info. exchange facilitator

INDICATORS

- Level of interest
- Attitude
  - positive
  - negative

INFORMATION TO OTHER COMPONENTS

To All Components

- Question raised at publi meetings

SHEET NO. ____ OF ____
MADE BY ______ DATE ______ CHECKED BY ______ DATE ______

HISTORIC - RESOURCES COMPONENT

INFORMATION FROM OTHER COMPONENT

From: Engineering

- Site to be cleared
- Alignments
- Crossings

From: Geol/Soils/Veg.

- Unusual terrain features at crossings

HISTORIC RESOURCES

- Historic LU patterns
- Prehistoric LU patterns
- Archeol. sites
- Interviews

INDICATORS

- No. and location of Historic Resources site

INFORMATION TO OTHER COMPONENTS

* To Public Participation

- Location of sites (?)

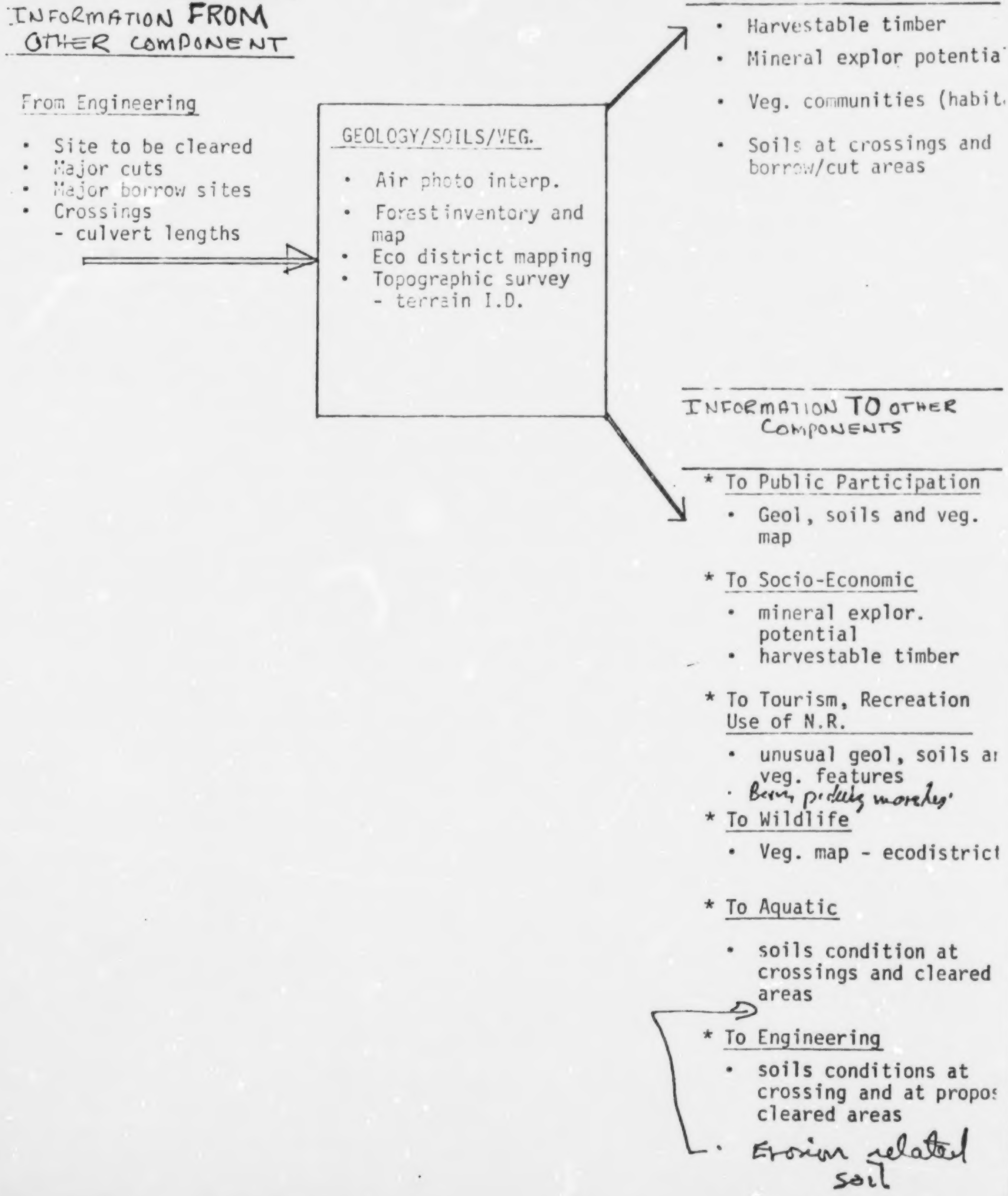
* To Socio-Economic

- Signifcance of sites in terms of social

* To Engineering

- Location of sites

GEOLOGY/SOILS/VEGETATION



INFORMATION FROM OTHER COMPONENT

From Engineering

- Site to be cleared
- Major cuts
- Major borrow sites
- Crossings
  - culvert lengths

GEOLOGY/SOILS/VEG.

- Air photo interp.
- Forest inventory and map
- Eco district mapping
- Topographic survey
  - terrain I.D.

INDICATORS

- Harvestable timber
- Mineral explor potentia
- Veg. communities (habit
- Soils at crossings and borrow/cut areas

INFORMATION TO OTHER COMPONENTS

* To Public Participation

- Geol, soils and veg. map

* To Socio-Economic

- mineral explor. potential
- harvestable timber

* To Tourism, Recreation Use of N.R.

- unusual geol, soils a veg. features
- Berry picking marshes

* To Wildlife

- Veg. map - ecodistric

* To Aquatic

- soils condition at crossings and cleared areas

* To Engineering

- soils conditions at crossing and at propos cleared areas
- Erosion related soil

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Jim Hancock

INFORMATION FROM OTHER COMPONENT

From: Geol/Soils/Veg.

- Veg map-in districts

From: Meteorology

- Annual snowfall
- monthly air temperature
- wind (speed & avg. rector)
- Freeze up - breakup timing

From: Public Participation

- Question raised at public meetings

From: Tourism, Rec. (& Subsist.) Use of Natural Resource

- No. people/year existing by type
- No users/year future by type
- Existing harvest - what, when, where
- Future harvest

From: Native Resource Use

- Existing harvest by species and time
- Future harvest by species and time

From: Engineering

- Construction schedule
- Road services in winter
- Traffic volume and timing
- Areas to be cleared
- Mancamp needs and location

WILDLIFE

- Wildlife pop in study area
- Ranges
- Future changes as result of road
  - construction
  - post construction
  - people
- Harvest related to product

INDICATORS

- Pop sizes (distribution)
- Habitat available
- Wildlife harvest

INFORMATION TO OTHER COMPONENTS

To: Public Participation

- Existing wildlife populat and their ranges
- Future changes as result of road - construction
  - people

To: Socio-Economic

- Existing wildlife harvest in dollars
- Future wildlife harvest in dollars

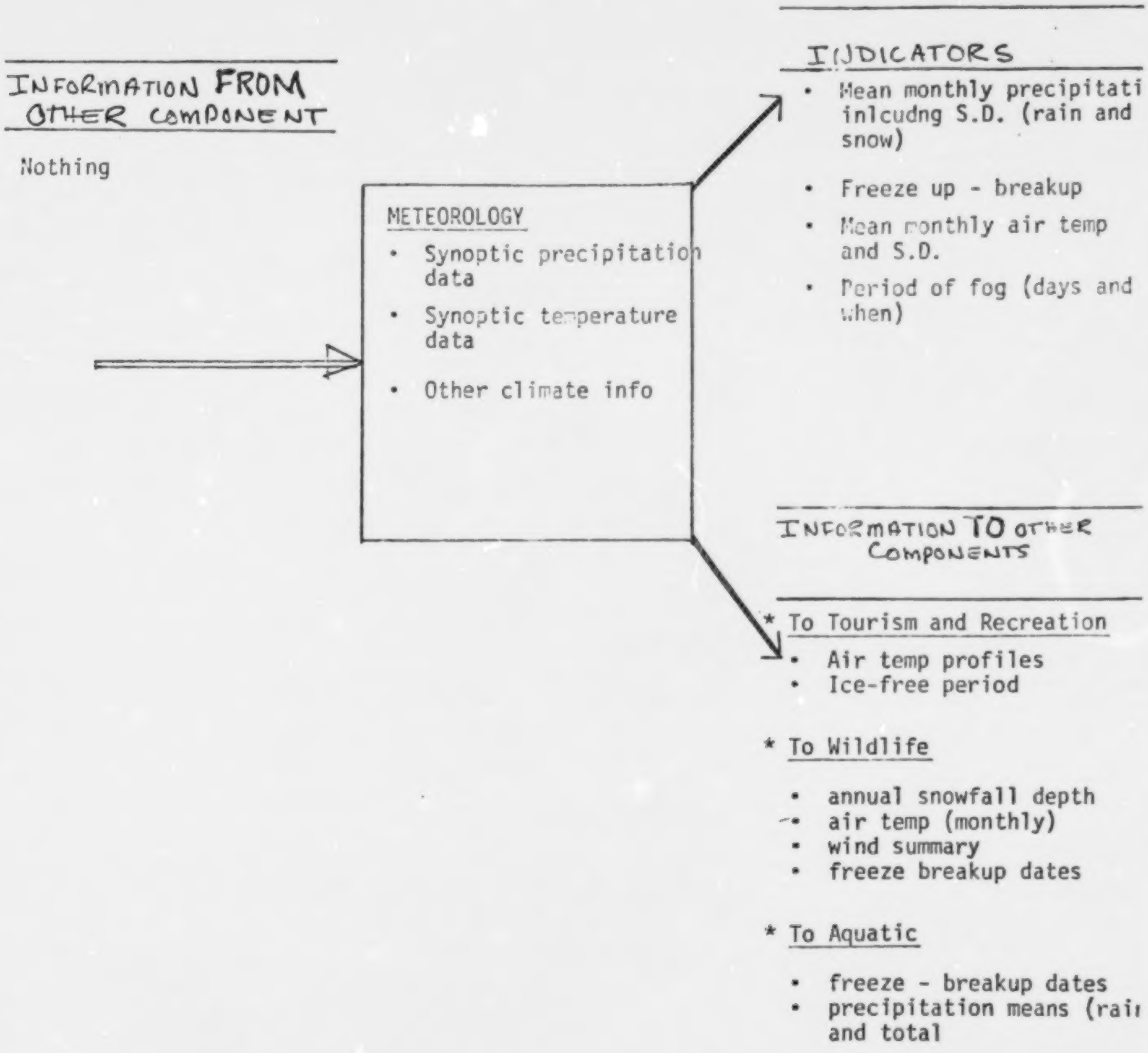
To: Tourism, Recr. (& Subsis Use of N.R.

- Available wildlife for obser. and hunting
  - caribou
  - furbearers
  - water ~~front~~ fowl and others

To: Engineering

- Location of major wildlif sensitive areas
  - crossings
  - wintering grounds
  - yarding areas

METEOROLOGY AND CLIMATE



INFORMATION FROM OTHER COMPONENT

Nothing

METEOROLOGY

- Synoptic precipitation data
- Synoptic temperature data
- Other climate info

INDICATORS

- Mean monthly precipitati inlcudng S.D. (rain and snow)
- Freeze up - breakup
- Mean monthly air temp and S.D.
- Period of fog (days and when)

INFORMATION TO OTHER COMPONENTS

* To Tourism and Recreation

- Air temp profiles
- Ice-free period

* To Wildlife

- annual snowfall depth
- air temp (monthly)
- wind summary
- freeze breakup dates

* To Aquatic

- freeze - breakup dates
- precipitation means (rai and total

____ OF ____

MADE BY ______ DATE ________ CHECKED BY ______ DATE ________

INFORMATION FROM OTHER COMPONENT

From: Geol/Soils/Veg.
- geol & soils condition at crossings & along alignment
- sensitive veg. at crossings & along alignment

From: Historic Resources
- significant sites to preserve

From: Meteorology
- annual snowfall, rain
- freeze up - break up (times)

From: Public Participation
- questions raised at public meeting

From: Socio Economic
- Available employee pool

From: Tourism - Recr. etc.
- Existing user pop (No/yr)
- Future user pop (No/yr)

From: Wildlife
- scheduling limits
- alignment constraints
- sensitive areas

From: Aquatic
- scheduling limits
- crossing methods suitability
- crossing structures suitability

ENGINEERING

- Alignment - Profile
- Crossing Structures
- Borrow and Fill
- Scheduling
- Employment needs
- Costs
- Maintenance plan
- Traffic volumes

INDICATORS

- Alignment
- Profile
- Cross-section
- Costs
- Scheduling
- Use (traffic)

INFORMATION TO OTHER COMPONENTS

To: Geol/Soil/Veg.
- Alignment
- Profile
- Borrow sites

To: Historical Resources
- Alignment
- Crossing locations
- Borrow cuts/fills

To: Public Participation
- Alignment & profile & crossings
- Scheduling
- Employ needs
- Mancamp requirements

To: Socio-Economic
- Employment needs
- Scheduling
- Capital & operating cos

To: Tourism - Rec. etc.
- Winter road service

To: Native Resource Use
- Winter road service

To: Wildlife
- Scheduling
- Road maint. (winter)
- Traffic volumes and timing
- Alignment clearing
- Mancamp requirements

To: Aquatic
- Water crossings
- Proposed structures
- Scheduling
- Mancamp needs

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TOURISM - RECREATION (AND SUBSISTANCE) USE OF NATURAL RESOURCES - COMPONENT

INFORMATION FROM OTHER COMPONENT

From: Geol/Soils/Veg

- Terrain features of significance to tourism

From: Historic Resources

From: Meteorology

- Air temp. profiles
- Ice-free period (deep)

From: Public Participation

- Questions raised at public meeting
- Public attitude

From: Native Resource Use

- Native harvest

From: Wildlife

- Available harvest
  - caribou
  - furbearers
  - waterfowl
  - other

From: Aquatic

- Available fish resources

From: Engineering

- Winter road maintenance plan

TOURISM, RECREATION & (SUBSISTANCE USE) OF NATURAL RESOURCE

- Exist. tourism and recreation use by user type including
  - resident, non-resident
- Non native subsistance use
- Future use by user type
- Harvest

INDICATORS

- No. of Tourists
  - now) when during
  - future) year
- Existing future resource harvest - wildlife
  - fish
  - forest?

INFORMATION TO OTHER COMPONENTS

To: Public Participation

- Existing use by resident and tourists
- Future use by type of use
- Harvest - existing
  - future

To: Socio-Economic

Existing

- No. tourists by type
  - camping - hiking
  - hunting
  - trapping
  - fishing
- Nature guiding opportunt·

Future (with road)

- same as above
- Infrastructure needs and servicing

To: Native Resource Use

- No. tourists by type (as above) existing
- Future tourism and use with road

To: Wildlife

- No. people/yr existing
  - hunting, trapping water fowl
- No. people/yr - future
- Existing and future harvest: subsistance and commercial

To: Aquatic

- same as wildlife but for fish

To: Engineering

- Existing tourist activity
- Future number tourists/yr and when

USE AND HARVEST OF NATURAL RESOURCES BY NATIVE PEOPLE

INFORMATION FROM OTHER COMPONENT

From: Public Participation

- Questions raised at public meetings

From: Tourism-Rec. (and Subsist.) Use

Existing

No. tourists/yr. by type
- camp
- hunt/trap
- fish

Future

- with road - as above

From: Engineering

- Road maintenance in winter

NATIVE RESOURCE USE

- Existing resource use
- Significant of resource i.e.,
  - food
  - income
  - other
- Future resource use with new road
  - improved access and transport

INDICATORS

- No. users
  - existing
  - future
- Level of harvest by species and time

INFORMATION TO OTHER COMPONENTS

To: Public Participation

- Existing resource use
- Future resource use

To: Tourism & Rec. (& Subsi Use

- Native resource use
  - existing
  - future

To: Wildlife

- Existing harvest by spec and time
- Future harvest by specie and time

To: Aquatic

- As above for wildlife

SOCIO-ECONOMIC COMPONENT

INFORMATION FROM OTHER COMPONENT

From: Geol/Soils/Veg.

- mineral explor. potential
- Harvestable timber

From: Historic Resources

- Social signif. of any sites ⇒

From: Public Participation

- Feedback from public meeting

From: Tourism, Rec. and Subsist Use of Natural Resources

Existing

- No. of tourists/yr by type
  - camp - hiking
  - hunting
  - fishing
  - trapping
- Native guiding opportunities

Future

- Same as above
- Infrastructure requirements
- Servicing needs

From: Native Resource Use

- Existing resource in
  - hunting/fishing/trapping
  - guiding
- Future - same as above

From: Wildlife

- Existing wildlife harvest in dollars
- Future wildlife harvest in dollars

From: Aquatic

- Existing aquatic harvest in dollars
- Future aquatic harvest in dollars

SOCIO-ECONOMIC

- Population
- Use of Services
- Housing
- Retail market
- Infrastructure
- Employment
- Community integration
- Fiscal IMPACT

INDICATORS

- Population changes
- No. jobs created and duration
- Community integration
- Fiscal Finance
- Retail Sales
- Impact on services existing and future cos

INFORMATION TO OTHER COMPONENTS

To: Public Participation

- Existing social structure of area
- Existing community condit (measures?)
- Future social structure with new road
- Future economic conditior with new road
  - use of services

From: Engineering

- Employment requirement
- Scheduling
- Capital Costs/Operating Costs
- Support services req.

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SUBJECT ________________ SHEET NO. ____ OF ____
MADE BY ______ DATE ________ CHECKED BY ______ DATE ______

INFORMATION FROM OTHER COMPONENT

From: Geol/Soil/Veg.

- soils condit at crossings
- soils condit at major cuts near water
- ~~stream-side veg. at crossing (general)~~

From: Meteorology

- Freeze - breakup (timing)

From: Public Participation

- Question raised at public meeting

From: Tourism REC & Subsist Use of N.R.

- Users/year existing by type
  - camping, hiking
  and loc. - fishing
  hunting/trapping
- Users/year future by type as above

From: Native Resource Use

- Existing harvest
  - what
  - when
  - where
- Future harvest sames as above

From: Engineering

- Crossing locations
- Construct schedule
- Type of structures proposed (culvert, bridges, etc.)
- Man camp requirements

AQUATIC

- Sensitive crossings
- Fish species present and quantity
- Movement and migration timing; barriers
- Habitat eval. by life stage and in stream flow requirements

INDICATORS

- Fishing Effort
- ~~Total Harvest~~
- Habitat - available and loss
  - use
- Fish pop. composition ~~and sizes~~
- Fish movement and migration (general
- Obstructions

INFORMATION TO OTHER COMPONENTS

To: Public Participation

- Existing aquatic resources at and near crossing
- ~~Existing harvest (total)~~
- Future changes to aquatic resource as result of roa and people

To: Socio-Economic

- Existing aquatic harvest value in dollars
- Future aquatic harvest value in dollars

To: Tourism-Rec. etc. Use

- Available fish resources when/where

To: Engineering

- Suitability of proposed w crossing structures
- Timing constraints

Appendix "E"

PHYSICAL/BIOPHYSICAL REVIEW
ROSS BAY JUNCTION TO CHURCHILL FALLS
TOTE ROAD

Northland Associates
August 9, 1985

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*Maps were made available to each component consultant and are available at DeLCan.

E.1 Geology, Geomorphology, and Soils

In western Labrador folded Precambrian sediments form a structurally controlled system of valleys and ridges (Lopoukhine *et al*., 1978). Within the study area, bedrock is of the Churchill (sedimentary, metamorphic and intrusive) and Grenville (quartzofeldspathic gneisses) Provinces (Greene, 1974). The bedrock types underlying the proposed and alternate routes are shown in Figure E.1-1.

Surficially, the study area is characterized by deep till and glaciofluvial deposits. Eskers and drumlin ridges are common, while organic terrain and bedrock outcrops do not occur often. More details of the surficial geology and soils of the study area follow in the next section.

E.1.1 Surficial Geology/Soils

Maps 1 and 2, which delineate the boundaries of ecosystems occurring within the proposed and alternate route corridors, also show the surficial geology along these corridors. This information has been derived from interpretation of 1:50,000 aerial photographs, and from a review of the geological studies of Fulton *et al* (1974) and Greene (1974).

The surficial material along the routes falls within 5 genetic categories:

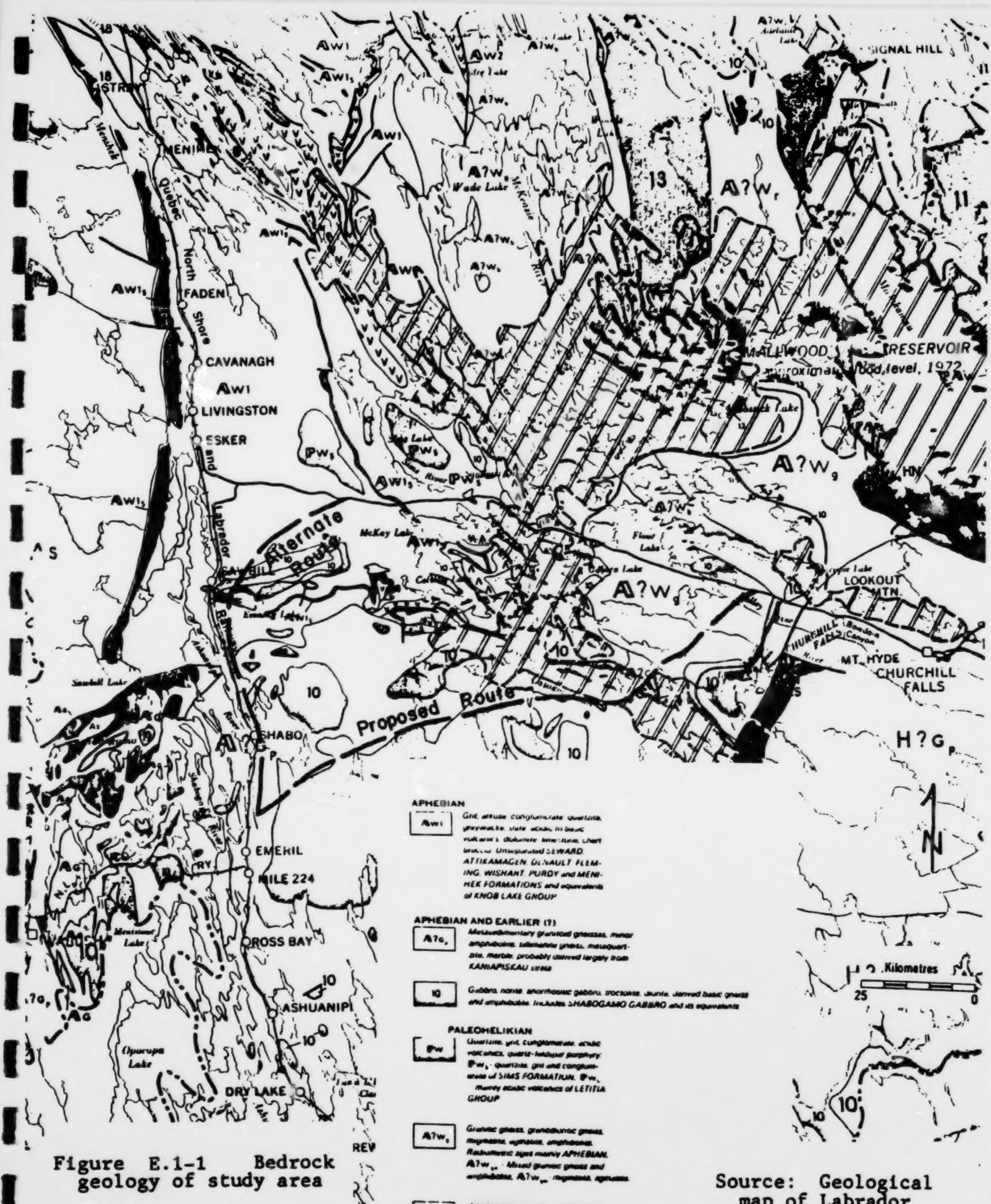
SIGNAL HILL
MENIHEK
Quebec North Shore and Labrador
FADEN
CAVANAGH
LIVINGSTON
ESKER
Wade Lake
McKay Lake
SMALLWOOD RESERVOIR
approximate flood level, 1972
Alternate Route
Proposed Route
LOOKOUT MTN.
CHURCHILL FALLS
MT. HYDE
CHURCHILL FALLS
Bowdoin Canyon
Sawbill Lake
SHABO
EMERIL
MILE 224
ROSS BAY
ASHUANIPI
DRY LAKE
Opocopa Lake
Menistouc Lake
Aw1
Aw1s
A?ws
A?wr
A?wg
Pw5
13
11
10
H?Gp
N
Kilometres
25
0
APHEBIAN
Aw1
Grit, arkose, conglomerate, quartzite, greywacke, slate, acidic to basic volcanics, dolomite, limestone, chert breccia. Unseparated SEWARD, ATTIKAMAGEN, DENAULT, FLEMING, WISHART, PURDY and MENIHEK FORMATIONS and equivalents of KNOB LAKE GROUP
APHEBIAN AND EARLIER (?)
A?c1
Metasedimentary granitoid gneisses, minor amphibolite, sillimanite gneiss, metaquartzite, marble, probably derived largely from KANIAPISKAU strata
10
Gabbro, norite, anorthositic gabbro, troctolite, dunite, derived basic gneiss and amphibolite. Includes SHABOGAMO GABBRO and its equivalents
PALEOHELIKIAN
Pw
Quartzite, grit, conglomerate, acidic volcanics, quartz-feldspar porphyry. Pw5 - quartzite, grit and conglomerate of SIMS FORMATION. Pw - mainly acidic volcanics of LETITIA GROUP
A?w
Granitic gneiss, granodioritic gneiss, migmatite, agmatite, amphibolite. Radiometric ages mainly APHEBIAN. A?w - Mixed granitic gneiss and amphibolite. A?w - migmatite, agmatite
A?c
Amphibolite, pyroxene amphibolite, chlorite schist, garnet - and biotite-rich gneisses

Figure E.1-1 Bedrock geology of study area

Source: Geological map of Labrador

- Morainal deposits
- Glaciofluvial deposits
- Colluvial deposits
- Organics
- Rock

Brief descriptions of these units follow. Table E.1.1-1 summarizes the extent of the occurance of the units within the routes.

Morainal Deposits: Mainly "till" or unsorted/poorly sorted to unstratified/partially stratified material (from clay to boulder size) that originated from direct deposition by ice without intervening water transport. Three morphological variations of the moraine deposit are found along the route corridors:

Moraine veneer: a thin (60 cm or less) veneer of morainal material normally occurring over bedrock or in association with organics. From a road construction perspective, this landform is relatively stable.

Hummocky moraine: rolling to steep and hilly terrain with roughly equidimensional hills and hollows, usually containing coarser materials and displaying greater depth (generally more than 3 m) than moraine veneer. Organics are normally present in the hollows. This landform is stable.

Drumlinoid: stream-lined hills of relatively deep (3 m or more) unsorted, coarse-textured morainal material.

TABLE E.1.1-1 The occurrence of surficial material along the proposed and alternate routes

Landform	Proposed Route		Alternate Route	
	No. of ecosystems containing landform	Stability	No. of ecosystems containing landform	Stability
Moraine				
- veneer	17 (37%)	Good	4 (17%)	Good
- hummocky	16 (35%)	Good	7 (30%)	Good
- drumlinoid	1 (2%)	Good	2 (9%)	Good
Moraine totals	34 (74%)		13 (57%)	
Glaciofluvial				
- ridged	2 (4%)	Good	1 (4%)	Good
- eroded	1 (2%)	Good	5 (22%)	Good
Glaciofluvial totals	3 (7%)		6 (26%)	
Colluvial - complex	6 (13%)	Poor	1 (4%)	Poor
Organics	1 (2%)	Poor	0	
Rock	2 (4%)	High	2 (9%)	High

Organics are usually found in the valleys between the hills. This is stable landform.

Glaciofluvial Deposits: Composed primarily of well- or poorly-sorted, and well-or poorly-stratified gravel and sand. This material is considered to have been deposited by glacial meltwater in proximity to ice. Two morphological variations of the glaciofluvial deposit occur along the route corridors:

Ridged: deep (more than 3 m) rolling to steep and hilly material with linear ridges and troughs; organics are always present in the troughs. This is good road-building material, relatively insensitive to disturbance except where near vertical faces are disturbed.

Eroded: deep (3 m or more) material disected by a series of closely-spaced gullies or a tightly-knit dendritic drainage network. This landform is relatively insensitive to disturbance except in the case of near vertical faces; is usually good construction material.

Colluvial Deposits: Loose material of various sizes, stratification and origin, which has accumulated on and at the foot of slopes by various processes of mass movement. One morphological form of colluvial material is found along the corridors:

Complex: this landform, usually a mixture of several morphological elements, is generally unstable when disturbed.

Organics: Peat, muck and other material of organic origin (generally unstratified) which commonly accumulate in closed basins or around gentle slopes. Organics within the proposed and alternate route corridors are primarily classified as "string bogs." These organics vary in depth between 1-3 m. Depths of up to 5 m may be found in isolated pockets throughout major deposits.

While organics constitute a minor component of most systems in the study area, only one ecosystem along the proposed route was classified as being purely organic. Organics are sensitive to disturbance. Nevertheless, organics encountered along the route will have to be excavated prior to road construction. Excavated material can later be used for rehabilitating/revegetating borrow areas.

Rock: Bare or moss-covered bedrock, or areas with a till mantle of up to 10 cm thick. Areas where near-surface rock severely restricts tree growth are included in this "rock" category.

The ble landforms (moraine and glaciofluvial) are
fou oximately 80% of the ecosystems within both the
pro alternate route corridors. However, because
fin ils particularly sensitive to surface erosion
(eg and, etc.) may occur in both moraine and glacio-
flu sits, side slopes of cuttings and embankments
not than two horizontal to one vertical will be
rec road construction in these materials.

A c ophysical description of the land base follows.

E.1.2 Biophysical Classification

Evaluation of terrain features along the proposed tote road right-of-way were completed using the Ecological Land Classification system as discussed in the guidelines for mapping by Lacate (1969). This method is based primarily on a systematic division of the study area into ecologically significant segments of biophysical environment composed of a pattern of landscapes, vegetation and water bodies. Depending on the amount of details required, the evaluation of biotic and physical resources within these segments may be presented as a broad pattern of contiguous landscapes (ecoregions and ecodistricts), or as an individual component of this pattern with some specific characteristics (ecosystems and ecotypes). The ecoregions, ecodistricts, ecosystems and ecotypes are main biophysical mapping units, arranged in a hierarchical order to express four intensity levels of integrated survey. The tote road survey was conducted at the ecosystem level.

Ecoregions - Proposed and Alternate Routes

An ecoregion in the hierarchical structure is a pattern of broad landscapes, usually an aggregation of several contiguous landscapes characterized by a distinctive regional climate and extending over large areas. The occurrence and growth of natural vegetation usually is related to prevailing climatic conditions.

The study area falls within three ecoregions as described by Lopoukhine et al. (1978) in Ecological Land Classification Series No. 4 (Figure 1). A brief verbatim description of each ecoregion is as follows:

"Ecoregion M - Smallwood Reservoir

(1) Location and Climate

The Smallwood Reservoir ecoregion, the largest in Labrador, is centered on the Smallwood Reservoir and extends south to include Atikonak Lake. A private road joining Esker (on the Quebec North Shore and Labrador Railway) and Churchill Falls (in Region S) traverses this Region.

Climate is continental. The reservoir and other large bodies of open water moderate the climate locally. The Mean Annual Temperature (MAT) is between -5° C and -2.5° C. Average annual precipitation is 800 mm of which 300 cm occurs as snow (Peach, 1975). Most of this region occurs in the scattered permafrost subzone. Mean annual growing season ranges between 100 and 120 days.

(II) Physiography

This region is characterized by esker and drumlin ridges. In the northeast corner the alignment of drumlins and eskers is east-west while in the southwest alignment is north-south. Bedrock outcrops are not common in this region of deep till and glaciofluvial deposits. Drumlinized till is dominant to the east while glaciofluvial material dominates in the west. Organic terrain, string bogs and fens, are prominent in the south and central

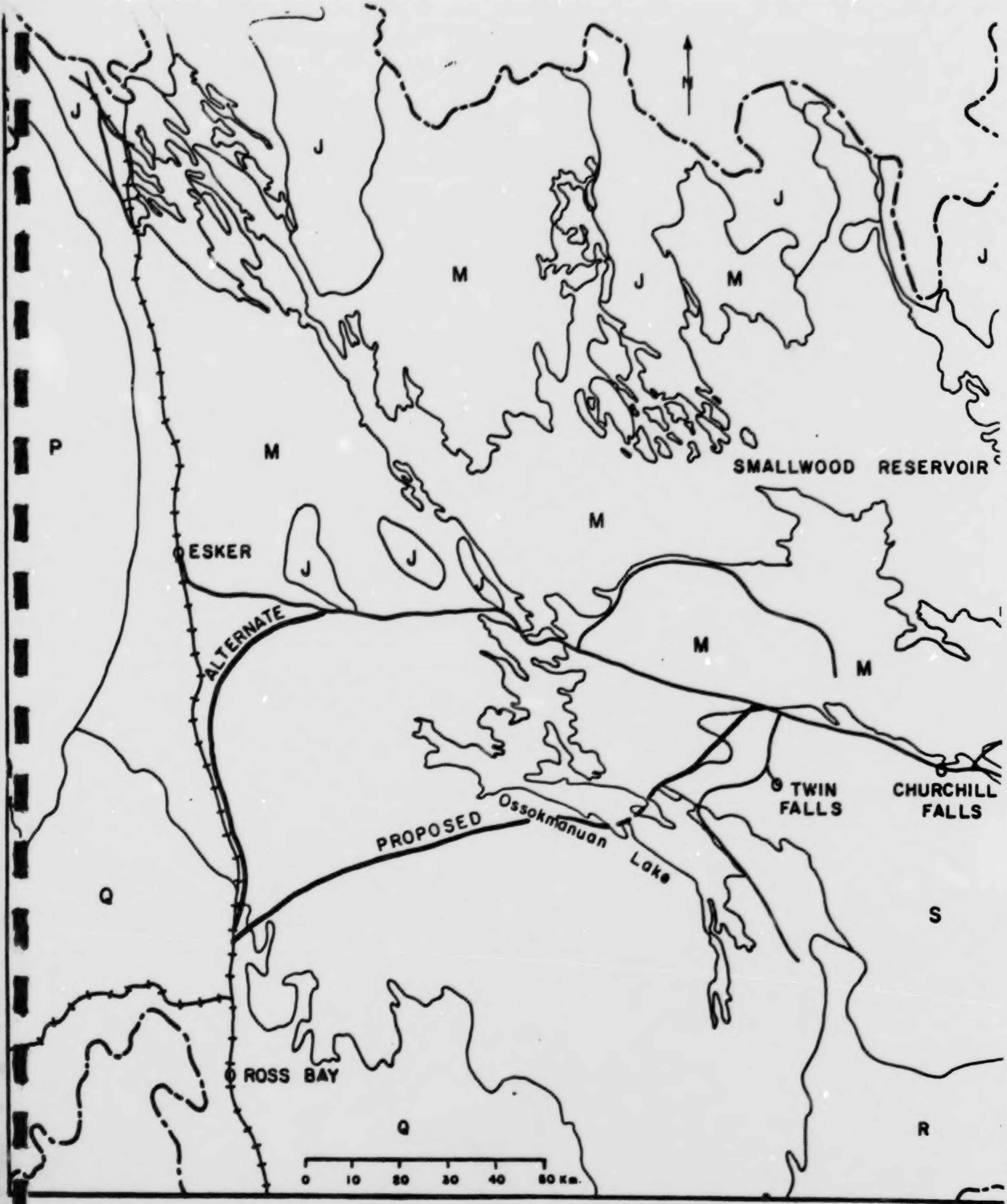
N
J
J
J
J
M
J
M
P
M
SMALLWOOD RESERVOIR
M
ESKER
J
J
ALTERNATE
M
M
TWIN FALLS
CHURCHILL FALLS
PROPOSED
Ossokmanuan Lake
Q
S
ROSS BAY
Q
R
0
10
20
30
40
50 Km.

Figure E.1.2-1 Ecoregions - proposed and alternate routes
(Source: Lopoukhine et al.,1978)

portions. The creation of Smallwood Reservoir innundated numerous small lakes and expanses of organic terrain.

Bedrock is of the Churchill and Grenville Structural Provinces. The Churchill Province rocks are sedimentary, metamorphic and intrusive. The Grenville rocks are mainly quartzofeldspathic gneisses (Greene, 1974).

(III) Vegetation

This part of Labrador is classified as subarctic forest (Rowe, 1972). This section (B13a), of the Boreal Forest Region, is between the productive forests to the south and the forest-tundra vegetation to the north. It is dominated by open lichen-woodlands with black spruce, the principal tree species. Bogs are numerous. On well-drained sites closed canopy forest stands of black spruce mixed with balsam fir and white spruce occur.

Ecoregion S - Churchill Falls

(I) Location and Climate

Churchill Falls ecoregion extends east from the settlement of Churchill Falls to the headwaters of the Kenamu River and south to the Labrador/Quebec boundary.

The climate is characterized by warm summers and cold winters. The maximum and minimum temperatures recorded at Churchill Falls are 30.6°C and -43.9°C respectively (Peach, 1975). The annual temperature averages just below -2.5°C. Precipitation averages 900 mm near Churchill Falls and 1100 mm at the Labrador/Quebec border. Snowfall between 400 and 500 cm is expected annually.

Scattered permafrost occurs in the region. Lakes are ice free for 150 to 180 days per average year and the mean annual length of the growing season is 120 days.

(II) Physiography

Broad river valleys, rolling topography and a preponderance of drumlinized till are characteristic of this region. Valleys are dominated by glaciofluvial material, recent alluvium and organic terrain. Upper slopes are covered with a veneer of till. Bedrock outcrops are most common near and at the top of the numerous hills. Impeded drainage has resulted in the development of organic terrain.

The bedrock in this part of the Grenville Province is principally paragneiss and granitic gneiss. The exact age of these Precambrian rocks is uncertain (Greene, 1974).

(III) Vegetation

The Boreal Forest Region (Section B-13a), encompasses the Churchill Falls ecoregion (Rowe, 1972). Lichen-black spruce woodlands are typical. Stream courses and the shores of lakes are lined by eastern larch whereas mesic sites are covered with closed canopy stands of white spruce and balsam fir in combination with the ubiquitous black spruce. Hilltops are commonly without tree cover. Numerous large burned areas attest to the frequency and intensity of fires.

Ecoregion Q - Seahorse

(I) Location and Climate

Ecoregion Q occupies the southwestern corner of Labrador.

Labrador City, Wabush and part of the right-of-way of the Quebec North Shore and Labrador Railroad lie within this region. Drainage is to the north through the large Joseph, Shabogamo and Ashuanipi Lakes.

Climate is continental. Annual precipitation is between 900 and 1000 m annually. Snowfall averages 400 cm per year and the MAT is slightly colder than $-2.5^{\circ}C$. The region is within the scattered permafrost subzone. Mean dates of complete freeze-up and first thaw of Wabush Lake are Oct. 26 and May 15, respectively.

(II) Physiography

Relatively level land interspersed with rolling terrain characterizes this region. The level areas are covered with large expanses of organic terrain while the rolling hills are composed of a mixture of veneer tills, glaciofluvial material and drumlins overlying bedrock. Ecodistrict Q-6, forming the southeastern part of Land Region Q, is hummocky with bedrock commonly exposed.

Both fast and slow flowing streams are present in the region. The subdued terrain contains the slow moving water forming large shallow lakes, while the upland areas contain many small lakes and swift streams.

Bedrock in this part of the Grenville Structural Province is paragneiss, granulite and sillimanite gneiss. The bedrock is of the Helikian and earlier age (Greene, 1974). Aphebian aged rock is represented in the Normanville fold belt along the western edge of the region.

(III) Vegetation

Ecoregion Q is contained by the Chibougamau-Natashquan Section (1b) of the Boreal Forest Region (Rowe, 1972). Black spruce is the dominant species. Larch is usually a minor component existing mainly on the margins of forest stands.

Wilton (1964) categorized the forest vegetation as submarginal and arctic tundra. Although Rowe's classification considers this area is productive, examples of good-growth stands are rare. Altitude, poor soils and perennial fires have hindered commercial forest development."

ECODISTRICTS - PROPOSED ROUTE

Ecodistricts as components of ecoregions, are characterized by a distinctive pattern of relief, geological structure, geomorphic evaluation and associated vegetational complex.

The location of ecodistricts as they occur within ecoregions is shown in Figure E.1.2-2. The descriptions of ecodistricts are derived from the mapping convention used by Lopoukine *et al*. (1978). Six ecodistricts were encountered along the proposed road right-of-way.

The proposed right-of-way crosses ecodistrict Q4 between kilometres 68.0 and 71.0. This ecodistrict is described as

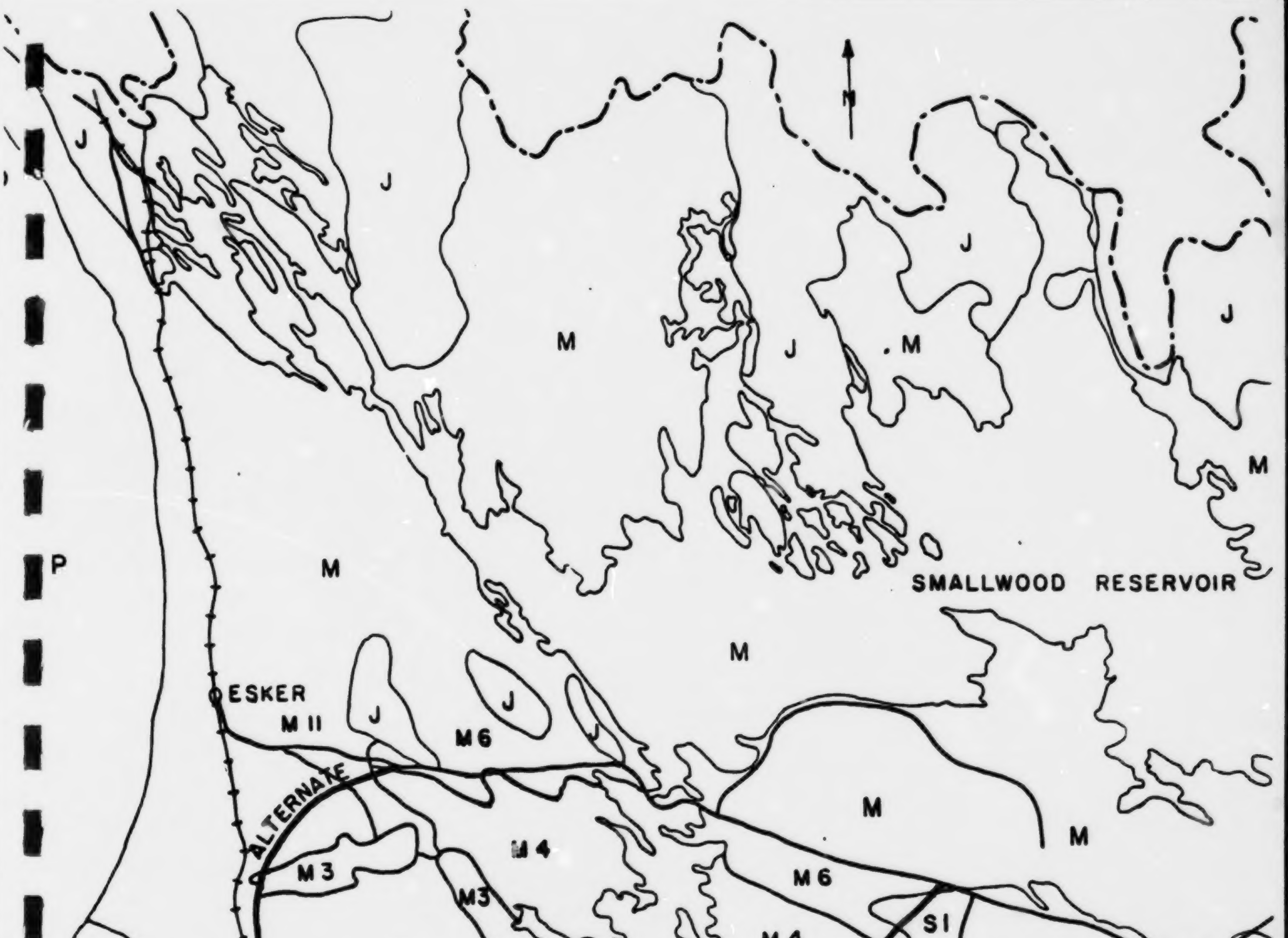
N
J
J
J
J
M
J
M
M
P
M
SMALLWOOD RESERVOIR
M
ESKER
M 11
J
J
M6
ALTERNATE
M
M
M 3
M 4
M3
M 6
S1
M 2
M 4
M 1
TWIN FALLS
CHURCHILL FALLS
Ossokmanuan Lake
PROPOSED
M 3
Q
Q3
M 3
S
Q 4
ROSS BAY
Q
R
0 10 20 30 40 50 Km

Figure E.1.2-2 Ecodistricts - proposed and alternate routes
(Source: Lopoukhine et al., 1978)

having relatively level topography with the genetic material composed of equal amounts of organics and moraines. The surface expression is indicated as being drumlinized and veneered. There is a continuous cover of vegetation consisting of sphagnum mosses, trees and lichens. Open fresh water bodies occupy between 31% to 40% of the area.

Ecodistrict M3 is present on the proposed right-of-way at three locations, ie. kilometres 71.0 to 85.0, 90.0 to 100.0, and 130.0 to 156.0. This ecodistrict is described as having corrugated and fluted topography. The genetic materials are composed primarily of glaciofluvials with exposed bedrock also present. The surface expression of the glaciofluvials is ridged and the bedrock is described as hummocky. There is a medium cover of vegetation consisting of trees, shrubs, lichens and mosses. Open fresh water bodies occupy between 11% and 20% of the area.

Ecodistrict M2 is present on the right-of-way at two locations, ie. kilometre 85.0 to 90.0 and 100.0 to 130.0. The topography is described as being level with eroded channels. The genetic material is composed almost exclusively of glaciofluvials. The surface expression of the glaciofluvials is described as complex. Organics occur as a minor component of the ecodistrict. There is a medium cover of vegetation consisting of lichens, trees and mosses. Open fresh water bodies occupy betwewen 11% and 20% of the area.

Ecodistrict M4 is present on the right-of-way between kilometres 156.0 and 184.5. The topography is relatively level. The genetic material is composed of organics, glaciofluvial complexes and drumlinized moraines. The area has a dense vegetation cover composed of mosses, shrubs, lichens, trees and sedges. Open fresh water bodies occupy between 21 and 30% of the area.

Ecodistrict M6 occurs between kilometres 184.5 to 189.5 and kilometres 195.5 to 199.0. The topography is described as being relatively level. The genetic material is comprised of equal amounts of organics and level glaciofluvials. Recent alluvium is also present along some streams. The area has a medium density cover of vegetation composed of mosses, lichens, trees and shrubs. Open freshwater bodies are present on approximately 21% to 30% of the area.

Ecodistrict S1 is present on the right-of-way between kilometres 189.5 and 195.5. The topography is described as being corrugated or fluted. Genetic materials are composed of drumlinized moraines with glaciofluvial complexes being less abundant. Organics are present. The area has a dense cover of trees, lichens and mosses. Open fresh water bodies occupy between 11% and 20% of the area.

ECOSYSTEMS - PROPOSED ROUTE (MAP NO. 1)

Ecosystems are subdivisions of ecodistricts delineated on the basis of a recurring pattern of landforms, soils and vegetation. An ecosystem may occur as simple or compound. A simple ecosystem is made up of a single landform, as for example, a relatively homogeneous moraine plain, or an extensive organic deposit. A compound ecosystem consists of several landforms where, in addition to a dominant landform, there occurs two or more other landforms intimately intermixed forming a complex landscape pattern (eg. organic-mineral soil complex).

Forty-six ecosystems were mapped by NORTHLAND ASSOCIATES LTD. throughout the proposed route. Approximately 62,271 ha of land and water mass constitute the study area along the proposed right-of-way. These ecosystems and descriptive legends are presented on Map 1.

Ecosystem 1 has a land mass of 588 ha. The topography is rolling and the hummocky moraines are deep (greater than 3 m). Soils are medium to fine-textured and belong to the humo-ferric and ferro-humic order of podzols. The system is well-drained with lichen black spruce forests occupying the drier knobs and black spruce moss forests on the slopes. String bogs are present where drainage is impeded. These organics are between 50 cm and 150 cm in depth.

This classification also applies to ecosystem 17 which has a land mass of 9,069 ha and a water mass of 766 ha.

Ecosystem 2 has a land mass of 388 ha. The topography is relatively flat. The surficial material is of glaciofluvial origin and has been reworked by water. The material is of medium texture and soils belong to the humo-ferric order of podzozls. The system is well-drained and lichen black spruce forests are present in the northern segment. String bogs (or fens) are present where drainage is restricted.

Ecosystem 3 has a land mass of 965 ha and a water mass of 67 ha. The topography is undulating and the surface material (originating from moraines) is hummocky. Soils are medium to fine-textured and belong to the humo-ferric order of podzols. The system is well-drained with lichen black spruce forests occupying the drier knobs and black spruce moss forests on the slopes. String bogs and fens are present in the depressions and drainage is retarded on these organics.

This classification applies to the following ecosystems which are presented below in tabular form:

Ecosystem	Land mass (ha)	Water mass (ha)
7	1,254	444
10	2,020	178
19	910	233
29	710	1,199
34	710	1,177
42	455	355
44	2,886	144

Ecosystem 4 has a land mass of 1,576 ha. The topography is hilly and surface material has originated from colluvium (on the slopes) and moraine veneer. Soils are well-drained toward the top of the slopes and moderately well-drained on the lower segments. Soils of the lower slopes probably belong to the gleysolic order while podzols will be present on the upper slopes. Black spruce-balsam fir forests will be present on the lower slopes but will grade into black spruce as the slopes are ascended. String bogs are present in localized depressions.

Ecosystem 5 has a land mass of 566 ha and a water mass of

11 ha. The topography is rolling and the surficial material is classified as being deep and shallow. The surficial material originated from relatively thin morainal deposits. Soils belong to the humo-ferric and ferro-humic order of podzols. Soils are moderately well-drained and of medium texture. Black spruce moss forest is present on all mineral soils throughout the system. String bogs are common throughout and range in depth between 50 and 150 cm. Drainage is retarded in these organic soils.

This classification also applies to ecosystem 36 which has a land mass of 455 ha; as well, ecosystem 38 which has a land mass of 1,143 ha and a water mass of 211 ha.

Ecosystem 6 has a land mass of 144 ha. The topography is undulating and the surface material is classified as shallow and deep. The surficial material originated from moraines and is classified as hummocky. Soils belong to the humo-ferric and ferro-humic order of podzols and are medium-textured and well-drained. Lichen black spruce forests are common on the drier areas with black spruce moss forests present on the slopes. Small string bogs or fens are present in depressions between hummocks.

Ecosystem 8 has a land mass of 799 ha. The topography is hilly and the surficial material is composed of veneer moraine. Soils are moderately coarse-textured and upper slopes are more rapidly drained than lower slopes. Ferro-humic and humo-ferric podzols will be present on upper slopes with gleysols possibly present on the lower slopes. Lichen black spruce will be present on the more rapidly drained slopes with black spruce and balsam fir moss forest occupying the wetter areas. String bogs constitute only a minor component of this ecosystem.

This classification also applies to ecosystem 9 which has a land mass of 455.1 ha.

Ecosystem 11 has a land mass of 466 ha. The topography is hilly and surficial material is composed of colluvial complex on the lower slopes and moraine veneer on the upper slopes. Soil textures vary from coarse to very coarse. Humo-ferric podzols are present on upper slopes with gleysols possibly present on the lower slopes. Black spruce moss forests, as well as lichen black spruce forests, will be found on the upper slopes, with black spruce-balsam fir mixed forests on the lower slopes.

This classification also applies to ecosystem 22, which has a land mass of 3,064 ha, and a water mass of 799 ha. As well, the classification applies to ecosystem 26, which has a land mass of 233 ha.

Ecosystem 12 has a land mass of 166 ha. The topography is undulating and soils are shallow and deep. The surficial material is composed of hummocky moraine. Soils are medium-textured and belong to the humo-ferric and ferro-humic order of podzols. Soils are well-drained and lichen black spruce forests are common throughout. String bogs are present in depressions and drainage on these organics is retarded.

This classification also applies to ecosystem 14, which has a land mass of 477 ha; as well, ecosystem 21 which has a land mass of 166 ha and a water mass of 56 ha.

Ecosystem 13 has a land mass of 411 ha. The topography is rolling and soils are deep and shallow. Surficial materials are composed of moraine veneer and hummocky moraine. Soils are medium to coarse-textured and belong to the humo-ferric and ferro-humic order of podzols. The area is well-drained and supports black spruce moss forests. Lichen black spruce is present on some of the drier knobs.

Ecosystem 15 has a land mass of 1,787 ha and a water mass of 78 ha. The topography is undulating and soils are shallow and deep. The surficial material is composed of moraine veneer. Lichen black spruce forests are present on the drier knobs with black spruce moss forests occupying the minor slopes. Soils are classified as ferro-humic and humo-ferric podzols. These soils are well- to rapidly-drained.

Ecosystem 16 has a land mass of 1,332 ha and a water mass of 189 ha. The topography is hilly and soils are shallow to bedrock. The surficial material is composed of moraine veneer, and rock outcrops are present. Soils are classified as ferro-humic and humo-ferric podzols. These soils are well- to rapidly-drained. String bogs are present in depressions. The mineral soils support black spruce moss forests.

Ecosystem 18 has a land mass of 178 ha. The topography is relatively flat and soils are classified as shallow and deep. The surficial material is composed of moraine veneer. Black spruce moss forests are confined to drainage channels. The area was recently burned and black spruce and hardwood is presently regenerating on the drier areas. Soils are classified as ferro-humic and humo-ferric podzols. String bogs are present in depressions.

Ecosystem 20 has a land mass of 266 ha. The topography is flat and surficial materials are composed of shallow organics. Drainage is retarded throughout the entire system. A minor component of hummocky moraine is present within the system. This material supports a sparse growth of lichen black spruce forest.

Ecosystem 23 has a land mass of 11 ha. The system is composed of exposed bedrock or bedrock covered with a few centimetres of organic material. The area is rapidly drained and supports scrub black spruce where organics are present.

This classification also applies to ecosystem 24, which has a land mass of 133 ha.

Ecosystem 25 has a land mass of 2,420 ha and a water mass of 111 ha. The topography is undulating and soils are deep and shallow. These soils are well-drained and belong to the humo-ferric and ferro-humic order of podzols. The surficial material is composed of hummocky moraine which supports black spruce moss forests on minor slopes and lichen black spruce forests on drier areas. String bogs are present in the depressions.

Ecosystem 27 has a land mass of 1,070 ha and a water mass of 56 ha. The surficial material is composed of moraine veneer over bedrock. Soils are shallow and deep and belong to the ferro-humic and humo-ferric order of podzols. Black spruce moss forests are present on lower slopes while black spruce-balsam fir forests occupy the upper slopes. The area is moderately well-drained. String bogs are present in the depressions between slopes.

Ecosystem 28 has a land mass of 966 ha and a water mass of 67 ha. The topography is hilly and surficial materials are composed of moraine veneer with colluvial complex present at the base of most slopes. Soils are classified as ferro-humic podzols on the upper slopes with gleysols probably present on lower slopes. The area is moderately well-drained and supports black spruce-balsam fir moss forests. Hardwoods are present along most active drainage channels. String bogs are present in most of the depressions between slopes.

Ecosystem 30 has a land mass of 1,476 ha and a water mass of 89 ha. The topography is shallow and deep and the surficial material is composed of moraine veneer over bedrock. Soils are classified as ferro-humic podzols with gleysols probably present near the base of lower slopes. The area is well-drained and soils are of medium to coarse-texture. The area supports black spruce-balsam fir forests on the slopes with scrub black spruce present on areas where the soil is shallow.

Ecosystem 31 has a land mass of 144 ha. The topography is hilly and soils are shallow and deep. The surficial material is composed of colluvial complex on lower slopes with moraine veneer present on the upper segments of slopes. Rock outcrops are present throughout the system. Soils are medium-textured and moderately well-drained. Humo-ferric podzols are present on upper slopes with gleysols probably occupying lower slopes. Black spruce-balsam fir forests occupy the slopes with scrub black spruce present on shallow soil near the rock outcrops.

Ecosystem 32 has a land mass of 411 ha. The topography is hilly and surficial materials are composed of colluvial complexes and moraine veneers. Soils are classified as humo-ferric podzols on upper slopes with gleysols probably present on lower slopes. The area is well-drained and black spruce-balsam fir forests are present throughout the entire system.

Ecosystem 33 has a land mass of 1,054 ha and a water mass of 122 ha. The topography is undulating and soils are deep and shallow. The surficial material is composed of ridged glaciofluvial deposits. The area is well-drained. Soils are classified as humo-ferric podzols having medium to fine textures. Black spruce lichen forests occupy the drier knobs with black spruce moss forests present along drainage channels. String bogs are present in most depressions.

Ecosystem 35 has a land mass of 1,066 ha and a water mass of 56 ha. The topography is rolling and surficial material is shallow and deep moraine veneer over bedrock. Soils are predominantly ferro-humic podzols and are well-drained. The area supports lichen black spruce forests with black spruce moss forests present along drainage channels. String bogs are present in several depressions.

Ecosystem 37 has a land mass of 2,631 ha and a water mass of 699 ha. The topography is rolling and soils are deep and shallow. The surficial material is composed of hummocky moraine. Soils are well-drained and consist primarily of humo-ferric podzols. Lichen black spruce forests are present on all mineral soils. String bogs occupy all depressional areas throughout the unit.

Ecosystem 39 has a land mass of 888 ha and a water mass of 766 ha. The topography is rolling and surficial materials are shallow to bedrock. Soils are moderately well-drained and are classified as ferro-humic podzols. The area supports lichen black spruce forests except where rock outcrops occur.

Ecosystem 40 has a land mass of 455 ha and a water mass of 355 ha. The topography is rolling and surficial material is deep and shallow. Soils are classified as ferro-humic podzols and are well-drained. The surficial material is composed of drumlinoid moraines which support a mixture of lichen black spruce forest and black spruce moss forest. String bogs are present throughout the ecosystem.

Ecosystem 41 has a land mass of 2,520 ha and a water mass of 144 ha. The topography is undulating and soils are shallow and deep. Soils are classified as humo-ferric and ferro-humic podzols and are moderately well-drained. The surficial material is composed of ridged glaciofluvials which support black spruce moss forests. String bogs are common throughout the entire ecosystem.

Ecosystem 43 has a land mass of 810 ha. The topography is undulating and soils are shallow and deep. The surficial material is composed of moraine veneer over bedrock. Soils are classified as ferro-humic podzols and are well-drained. Sparse black spruce moss forest occupies most of the system, with hardwoods present along drainage channels. String bogs and fens are present in depressions.

Ecosystem 45 has a land mass of 278 ha. The topography is hilly and soils are shallow and deep. Surficial materials are composed of moraine veneers and colluvial complexes. Soils are moderately well-drained and are classified as ferro-humic podzols on upper slopes with gleysols probably present on lower slopes. Black spruce and balsam fir moss forests occupy the lower- and mid-slopes with lichen black spruce present on the upper slopes. A pure stand of hardwood is also present on the lower slopes of this ecosystem. Scrub black spruce occupies the thin organic layer over bedrock at the higher elevations.

Ecosystem 46 has a land mass of 222 ha. The topography is rolling and soils are shallow and deep. Surficial material is composed of moraine veneer over bedrock. Soils are classified as ferro-humic podzols and are well-drained. The ecosystem supports black spruce moss forest on the slopes, with lichen black spruce forest and scrub black spruce present where soils are shallow.

ECODISTRICTS - ALTERNATE ROUTE

Ecodistrict M3 enters the east side of the right-of-way of the alternate route at kilometre 72.0 and 74.0. This ecodistrict is also present between kilometre 121.0 and 124.5. A description of ecodistrict M3 was presented for the proposed route.

Ecodistrict Q4 is present between kilometre 68.0 and 81.0 of the alternate route. This ecodistrict was also described for the proposed route.

Ecodistrict Q3 is present on the west side of Wightman Lake at kilometre 76.0 of the alternate route. The topography is described as being corrugated and fluted. The genetic material is composed of morainal materials. The surface expresssion of the moraine is drumlinized. Organics and glaciofluvial complexes are also present. There is a continuous cover of vegetation consisting of trees, lichens and mosses. Open fresh water occupies between 31% and 40% of the area.

Ecodistrict M2 is present on the right-of-way between kilometre 81.0 and 121.0 and between kilometre 124.5 and 139.0. This ecodistrict was previously described for the proposed route.

Ecodistrict M11 is present between kilometres 139.0 and 150.5. The topography is described as corrugated and the genetic materials are primarily glaciofluvial complexes. Organics and hummocky moraines are also present. Vegetative cover is of medium density and is composed of trees, mosses and lichens. Open fresh water is present on 21% to 30% of the area.

Ecodistrict M4 is present on the right-of-way between kilometres 150.5 and 155.0. This ecodistrict was described for the proposed route.

Ecodistrict M6 is present between kilometres 155.0 and 157.0. This ecodistrict was also described for the proposed route.

ECOSYSTEMS - ALTERNATE ROUTE (MAP NO. 2)

Ecosystem 1 has a land mass of 566 ha. The topography is rolling and the surficial materials are deep. The area is well-drained and soils are classified as ferro-humic podzols. The surficial material consists of hummocky moraine. Black spruce moss forests occupy the slopes with lichen woodland on the drier knobs. String bogs are present when drainage is impeded.

Ecosystem 2 has a land mass of 1,243 ha, and a water mass of 22 ha. The topography is undulating and surficial materials are deep and shallow. Soils on the hummocky moraine are medium- to fine-textured and belong to the humo-ferric order of podzols. Lichen black spruce forests are present on the drier knobs with black spruce moss forests on minor slopes. String bogs and fens are present in the depressions and drainage is retarded on these organics. This classification also applies to ecosystem 23 which has a land mass of 466 ha and a water mass of 11 ha.

Ecosystem 3 has a land mass of 644 ha and a water mass of 22 ha. The topography is relatively flat. The surface material is of glaciofluvial origin and has been reworked by water. The material is of medium texture and soils belong to the humo-ferric order of podzols. The system is well-drained and lichen black spruce forest is present. String bogs and fens are present where drainage is retarded.

This classification also applies to ecosystem 6 which has a land mass of 410 ha and a water mass of 44 ha.

Ecosystem 4 has a land mass of 3,230 ha and a water mass of 677 ha. The topography is rolling and the surficial materials are deep and shallow. The surficial material is composed of hummocky moraine and medium-textured ferro-humic podzols are common throughout. The system is well-drained and supports lichen black spruce forests on the drier knobs with black spruce moss forest common along drainage channels.

This classification also applies to ecosystem 7 which has a land mass of 888 ha and a water mass of 44 ha.

Ecosystem 5 has a land mass of 455 ha. The topography is hilly and the surficial material is deep and shallow. Gleysols may be present on the steep slopes with humo-ferric podzols on the drier uplands. Black spruce moss forests are present on the steep slopes with lichen black spruce forests occupying the lowlands. The area is moderately well-drained.

Ecosystem 8 has a land mass of 4,740 ha and a water mass of 122 ha. The topography is flat and the surficial material is deep and shallow. The surficial material is composed of hummocky moraine and supports lichen black spruce forests on the drier knobs with black spruce moss forests occupying the drainage channels between the hummocks. Soils are classified as belonging to the humo-ferric order of podzols. String bogs are present in depressions.

This classification also applies to ecosystem 11, which has a land mass of 122 ha.

Ecosystem 9 has a land mass of 78 ha. The topography is relatively flat and the surficial material is deep. The system is composed of a series of small glaciofluvial islands in Molson Lake. Soils are classified as humo-ferric podzols and support lichen black spruce forests.

Ecosystem 10 has a land mass of 3,130 ha and a water mass of 233 ha. The topography is rolling and surficial materials are shallow and deep. Soils are classified as humo-ferric podzols and are well-drained. Surficial material is composed of medium-textured hummock moraines. Lichen black spruce forests are present at the tops of hummocks with black spruce moss forests confined to the minor slopes. String bogs are occasionally present in depressions.

Ecosystem 12 has a land mass of 266 ha and a water mass of 11 ha. The topography is hilly. Surficial material is classified as shallow and bare and consists of moraine veneer and bedrock. Soils are rapidly drained and are classified as ferro-humic podzols. Soil texture ranges from medium to coarse.

Ecosystem 13 has a land mass of 11 ha. The topography is flat and surficial materials are deep. Soils belong to the humo-ferric order of podzols. Surficial material is composed of ridged glaciofluvials and is rapidly drained. Materials are coarse-textured and support lichen black spruce forests.

Ecosystem 14 has a land mass of 11 ha. This area consists of a rockey mound with scrub black spruce on the slopes. Black spruce moss forest is present at the base of the small hill. Surficial material is classified as shallow and bare.

Ecosystem 15 has a land mass of 11 ha. The topography is undulating and surficial materials are shallow and bare. Rock outcrops are present. Soils are classified as ferro-humic podzols and are of medium texture. The system is well drained. Lichen black spruce forests are present throughout with scrub black spruce near the rock outcrops.

Ecosystem 16 has a land mass of 366 ha and a water mass of 22 ha. The topography is rolling and the surficial material is deep and shallow. Soils are well-drained and are coarse in texture. Surficial materials are classified as eroded glaciofluvials with moraine veneer also present. The vegetation is primarily lichen black spruce forest. Soils are classified as belonging to the humo-ferric order of podzols.

Ecosystem 17 has a land mass of 5,572 ha and a water mass of 544 ha. The topography is rolling and surficial materials are deep and shallow. Soils are medium- to coarse-textured and belong to the humo-ferric order of podzols. Surficial materials are classified as drumlinoid moraines and support lichen black spruce forests. String bogs are present in most depressions.

This classification also applies to Ecosystem 19 which has a land mass of 5,028.3 ha and a water mass of 743.7 ha, and it also applies to Ecosystem 21, which has a land mass of

4,428.9 ha, and a water mass of 821.4 ha.

Ecosystem 18 has a land mass of 726 ha. The topography is hilly and surficial materials are shallow and deep. Soils are medium-textured and belong to the humo-ferric order of podzols. Surficial materials are classified as moraine veneer with colluvium present on the slopes. The area is rapidly drained and lichen black spruce forests are common throughout with black spruce moss forests on some sheltered slopes. String bogs are present in a few depressions.

Ecosystem 20 has a land mass of 955 ha and a water mass of 56 ha. The topography is flat and surficial materials are deep. The area has been burned and is now regenerating to hardwoods and black spruce. Soils are classified as humo-ferric podzols and are coarse in texture. Surficial materials consist of eroded glaciofluvials and eroded moraines.

Ecosystem 22 has a land mass of 1,743 ha and a water mass of 122 ha. The topography is undulating and surficial materials are deep and shallow. Soils are classified as humo-ferric podzols and are moderately coarse in texture. Surficial materials are composed of moraine veneers and support lichen black spruce forests. String bogs are common throughout.

MAJOR STREAM CROSSINGS - PROPOSED ROUTE

Km 85.5	Lichen black spruce forests on both sides Coarse-textured sands and gravels (glaciofluvials) 10% slope to water on east side 30% slope to water on west side (esker ridge) Stream crossing approximately 25 feet
Km 138.0	Lichen black spruce forests on both banks Coarse-textured sands and gravels (moraine) 15% slope to water on both banks Stream width approximately 60 feet
Km 156.5	Innundated shoreline Lichen black spruce forests on both banks Medium- to coarse-textured sands and gravels (glaciofluvial) 30% slope to water on north bank 10% slope to water on south bank Stream width approximately 550 feet.
Km 158.0	Innundated shoreline Lichen black spruce forests on both banks Medium- to coarse-textured sands and gravels (glaciofluvial) 10% slope to water on both banks Stream width approximately 834 feet.
Km 160.5	Flooded shoreline Lichen black spruce forests on both banks Medium- to coarse-textured sands and gravels (moraine) 10% slope to water on both banks Stream width approximately 626 feet

KM 162.0	Flooded shoreline Lichen black spruce forests on both banks Medium- to coarse-textured sands and gravels (moraine) 25% slope to water on north bank 10% slope to water on south bank Stream width approximately 2,419 feet
Km 163.0	Flooded shoreline String bog on north side of stream - organic material Lichen black spruce on south side on medium-textured sand and gravel North side is flat South side has 10% slope to water Stream width 417 feet (approximately)
Km 166.0	Flooded shoreline Lichen black spruce forests on both banks Medium- to coarse-textured sand and gravel (moraine) 15% slope to water Stream width 626 feet (approximately)

MAJOR STREAM CROSSINGS - ALTERNATE ROUTE

Km 86.5	(Miron River) Lichen black spruce forests on both banks 45% slope to water on both banks Medium- to fine-textured sands and gravels (dissected terrace - glaciofluvial) Stream width approximately 250 feet
Km 103.5	(Bernadette River) Lichen black spruce forests on both banks 10% slope to water on both banks Medium-textured sands and gravels (moraine) Stream width approximately 110 feet
Km 121.0	(Evening River) Lichen black spruce forests on both banks, willow fringe near water 10% slope to water on both banks Coarse- to medium-textured sands and gravels (moraine) Stream width approximately 170 feet
Km 130.0	Lichen black spruce forests on both banks 15% slope to water on both banks Coarse- to medium-textured sands and gravels (moraine) Stream width approximately 700 feet
Km 147.5	Lichen black spruce on both banks Island in centre of stream with black spruce vegetation East bank to island approximately 40 feet 30% slope to water on east bank (esker ridge, coarse-textured sands and gravels) Island approximately 200 feet wide 5% slope to water on west bank West bank to island 65 feet

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E.2 Vegetation

The scale of aerial photography provided (1:50,000) for the evaluation of the vegetation resources along the proposed and alternate route did not permit assessment of the resource at the ecotype level. Vegetation was evaluated at the forest cover type level which gives a species breakdown, a height class and a density class.

There are 27 productive forest stands (producing at least 45 m^3 per ha) along the proposed road corridor (Section 3.6.2.7). These stands, occupying a total area of approximately 10,612 ha, are composed of Balsam Fir and Black Spruce, with occasional occurrences of Trembling Aspen, White Birch and Balsam Poplar. Ground vegetation under these forest stands usually consists of a continuous moss cover (eg. *Hylocomium* and *Pleurozium*) with such shrubs as Sheep Laurel (*Kalmia angustifolia*) and Labrador Tea (*Ledum groenlandicum*) occasionally present.

Elsewhere along the corridor of the proposed route the remaining land mass is occupied by scrub forests and organics. Scrub forests (which include lichen woodland) are vegetation types which are producing less than 45 m^3 per ha of wood fibre. Black Spruce is the principal tree species in this lichen-woodland.

The understory of this lichen woodland is usually dominated by various species of Cladonia (C. alpestris, C. rangiferina, C. mitis), with other lichens occurring less frequently. Mosses, such as the Hairycap Moss (Polytrichum juniperinum), are also present in particular areas (Northland Associates, 1980).

Clubmosses (Lycopodium sp.) are generally common in the herb layer, with the shrub layer consisting mainly of such ericaceous shrubs as Sheep laurel, Labrador Tea and Blueberry (Vaccinium angustifolium).

Scrub forest types and organics are present along the alternate route corridor. As in the case of the proposed route, these types occupy the more nutrient-poor sites.

Seepage water can be anticipated at the base of steeper slopes of the higher hills. This should not present problems if environmentally sound engineering practices are adhered to.

As far as can be determined from a review of existing information, the study area does not contain any rare or unique vegetation community. The subarctic forests, of which the study area is a part, stretch in a broad band across central

Labrador and much of north-central Quebec. While there are regional variations in vegetation communities over this vast distance, no region or area is substantially different from any other. Consequently, construction of the road in either the proposed or alternate location is unlikely to adversely affect the overall structure and composition of the vegetation communities in the region or area.

E.3 Mineral Resources

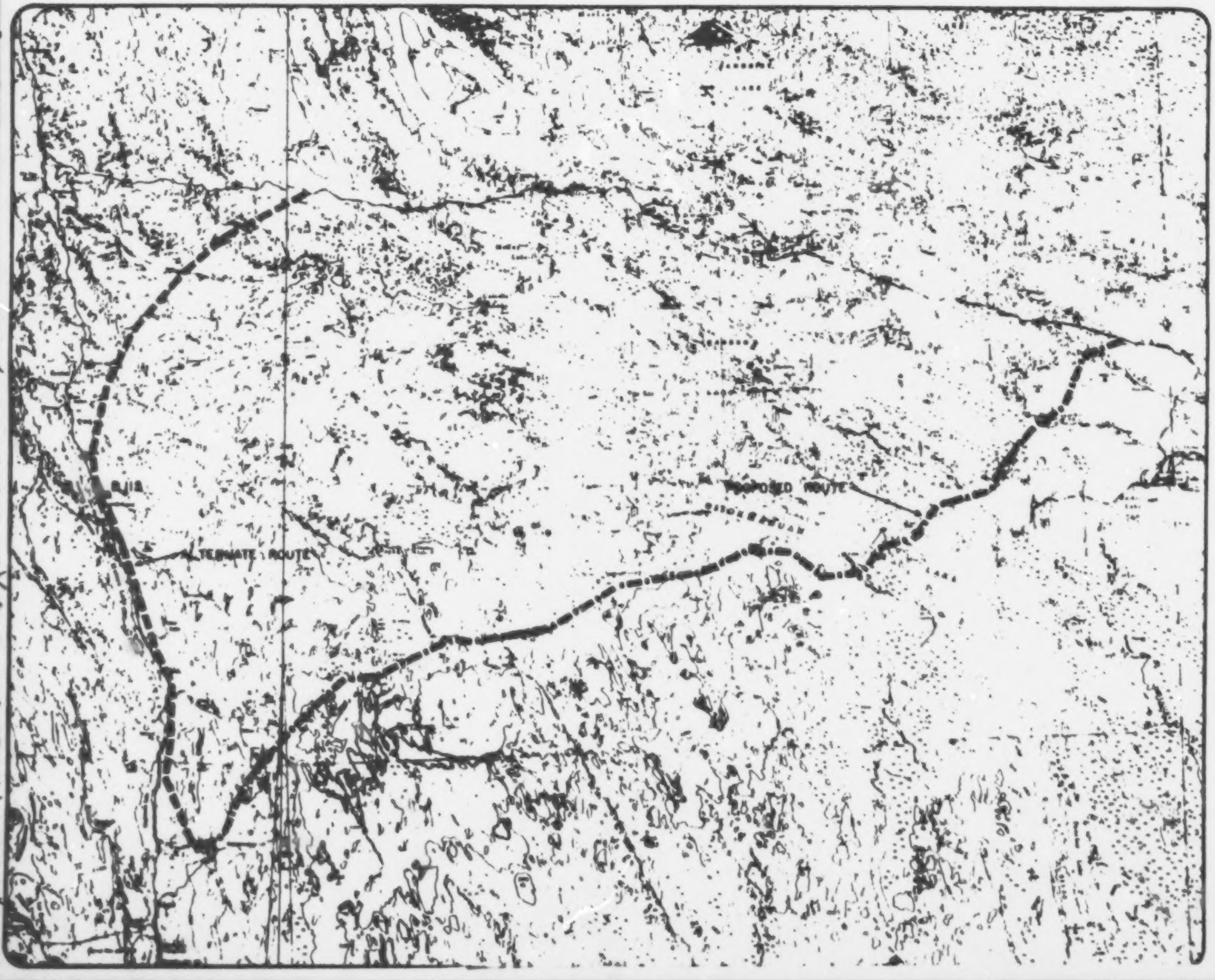
The Ross Bay-Churchill Falls Esker triangle, including the proposed and alternate route corridors, is considered to have a low potential for mineral occurrences (Mineral Development Division, pers. comm.). The bedrock of the area is of the Churchill and Grenville Provinces of the Canadian Shield (Greene, 1974), and is thus different from the rocks of much of the Labrador trough. However, geological reconnaissance in the study area has been limited because of lack of easy access, and further exploration may discover some mineral occurrences of interest.

There are approximately 15 mining leases in the area. The precise number can be determined by a detailed search of Mines and Energy files to identify the leases which have not yet lapsed. These leases represent the more promising remnants of the concession held by the Labrador Mining and Exploration Co. Ltd. (LMECL), a Montreal-based company whose parent is Norcen Energy Ltd. All of these leases will expire within 10 years.

None of the LMECL leases occur within the proposed route corridor, but at least one is located within 5 km of the corridor and several others within 15-20 km. However, the proposed route does cross a narrow section of the land to which the Churchill Falls (Labrador) Corporation Ltd. (CFLCo.) has been granted mineral rights. In the mid-1960s, CFLCo. was given a 99-year lease to the mineral rights on the lands that would be flooded by the Churchill Falls hydroelectric development. The section which will be crossed by the proposed route lies in the vicinity of Ossokmanun Lake. Most of the CFLCo. mineral lease is now covered by water.

The alternate route does encroach on the western portion of LMECL lease block B.112 (Figure E.3-1). This lease.is 4,478.9 acres in size. Three other leases lie within 5 km to the east of the alternate route corridor. A survey description of lease B.112 is on file with the Mineral Lands and Mining Branch of the Department of Mines and Energy in St. John's.

The construction of the tote road, either the proposed or alternate route, will have a positive impact on mineral exploration activity. Whether a mining development will result remains to be seen.


B.112
PROPOSED ROUTE
ALTERNATE ROUTE

ROSS BAY JUNCTION-CHURCHILL FALLS
TOTE ROAD
ENVIRONMENTAL IMPACT ASSESSMENT

Figure E.3-1 Location Of Mining Lease B.112

SCALE 1:400,000
km
DATE:
CONSULTANT: Northland Associates
TRANSPORTATION

E.4.. Valued Ecosystem Components

E.4.1 Socio-economic Factors

Mining - The area is considered to have limited potential for mining development. However, construction of either the proposed or alternate route will likely result in an increase in the level of mineral exploration in the area, creating a small number of seasonal jobs in the process.

Forestry - No large scale job creating enterprise will materialize in this sector. The forestry resource of the study area will not support a viable forest industry such as pulp and paper or sawlogs. However, construction of the proposed route could provide an incentive for local residents to pursue a small firewood retailing business, or, at the very least, for local residents to harvest adequate supplies of firewood for their own use.

The potential for firewood is very limited on the alternate route.

E.4.2 Native Resource Use

Comments in Section E.4.1 apply here.

E.4.3 Tourism and Recreational Use

Construction of the road through areas of fine materials could result in the entry of sediments into adjacent water bodies. Stream crossings offer the greatest potential for siltation because of erosion. Serious siltation could negatively affect the use of waterways for fishing and camping.

The alternate route will cross more streams than the proposed route.

E.4.4 Caribou, Fish, Other Wildlife

Siltation of waterways could negatively affect fish spawning and rearing habitat, and waterfowl feeding areas.

Because the proposed route crosses more streams and passes through an area that is essentially wilderness (more likely to have larger fish and waterfowl populations) this route has more potential for negative impact through siltation than the alternate route.

The potential for timber harvesting (firewood in particular) is greater along the proposed route than the alternate. Such harvesting, if extensive, would alter wildlife habitat both negatively and positively. The removal of mature trees would create openings in the forest, and such wildlife as moose, snowshoe hares, mice, and some game birds would be attracted to the new growth that develops in the openings. Species such as lynx and foxes which prey on hares, etc. will follow their prey into the cutover area.

Negative impact may result if timber harvesting removes shade trees which overhang fish spawning habitat. Spawning habitat without shade will receive little use. While not a major concern at present, timber harvesting will likely cause a negative impact to caribou if the Lac Joseph herd expands to the point where animals occupy the area of the proposed route on a regular basis. Unlike moose, caribou do not use the new growth that develops in cleared areas. Caribou use the forests for cover and shelter in winter, and feed on the arboreal lichens that are found there.

E.4.5 Forest Resources

The forest resources of the study area do not have the potential to support a viable forest industry such as pulp and paper or sawlogs (Dept. of Forest Resources and Lands, pers. comm.). Our inventory statistics (derived from 1:50,000 scale photo interpretation only) support this view: there are no productive forest stands (capable of producing more than 45 m^3 per ha) along the alternate route corridor and an estimated gross merchantable volume of 426,720.8 m^3 in the 27 productive stands within the proposed route corridor. This latter volume represents approximately 6 m^3 of merchantable timber per ha for the corridor, considerably less than the requirement for an economic forest harvesting operation.

Inventory statistics for the 27 stands along the proposed route are given in Table E.4.5-1.

Lichen woodland forests are areas of high fire hazard because of the frequently dry condition of the *Cladonia* ground cover. Lightning strikes often start fires in this forest type, and careless human or vehicular activity will add to the problem. A deep ground fire may change soil drainage patterns and lead to an increase of erosional processes in the area. An extensive fire would also destory wildlife habitat, timber resources and reduce aesthetic value. Fire prevention measures should be strictly enforced.

Blowdowns along the cut edge of the right-of-way through the productive forest stands on the proposed route also represent a potential fire hazard.

TABLE E.4.5-1 Forest inventory statistics - proposed route

Stand No.	Stratum	Area (ha)	Gross merchantable volume m^3
1	bSbF 43	1,222.1	9,084.2
2	bSbF 32	975.5	43,995.0
3	bSbF 32	585.1	26,388.0
4	bsBF 32	329.4	14,855.9
5	bS 33	45.5	1,915.6
6	bSbF 33	445.0	18,734.5
7	bS 33	60.0	2,526.0
8	bSbF 43	81.9	6,093.4
9	bSbF 32	1,019.2	45,965.9
10	bSwB 33	20.0	2,202.0
11	bSbF 32	113.8	5,132.4
12	bSbF 32	104.7	4,722.0
13	bSbF 32	688.0	31,028.8
14	bS 32	27.3	1,231.2
15	bS 33	2,730.0	114,933.0
16	bSbF 32	1,092.9	49,289.8
17	bS 33	26.4	1,111.4
18	bS 32	35.5	1,601.1
19	bS 32	58.2	2,624.8
20	bS 32	51.0	2,300.1
21	bS 32	230.2	10,382.0
22	bS 32	197.5	8,907.2
23	bS 32	72.8	3,283.3
24	bS 32	199.3	8,988.4
25	HS 42	7.3	720.5
26	bS 32	124.7	5,624.0
27	bS 32	68.3	3,080.3
TOTAL			426,720.8 m^3

E.4.6 Special Areas

No International Biological Program (I.B.P.) sites lie within the study corridors of either the proposed or alternate tote road routes. Two sites (Thomas Falls and Churchill Falls, 10 and 15 km distant respectively) are located west of the proposed route, and one site (Menihek Lake, 15 km distant) north of the alternate route. Descriptions of these three sites are given below. Figure E.4.6-1 shows the locations of the sites in relationship to the tote road routes.

Menihek Lake (I.B.P. No. 8-37)

Co-ordinates: 53°48-51'N 66°15-25W

Status: Supplementary Site.

Size: 35 km^2

Description: Lichen forest (white spruce-vaccinium-cladonia) on glacial drift; some peatland.

Approximate distance from road corridor: 15 km.

Thomas Falls (I.B.P. No. 8-70)

Co-ordinates: 53°31'N 64°30'W

Status: Low priority. No other information given.

Approximate distance from road corridor: 10 km.

Churchill Falls (I.B.P. No. 8-57)

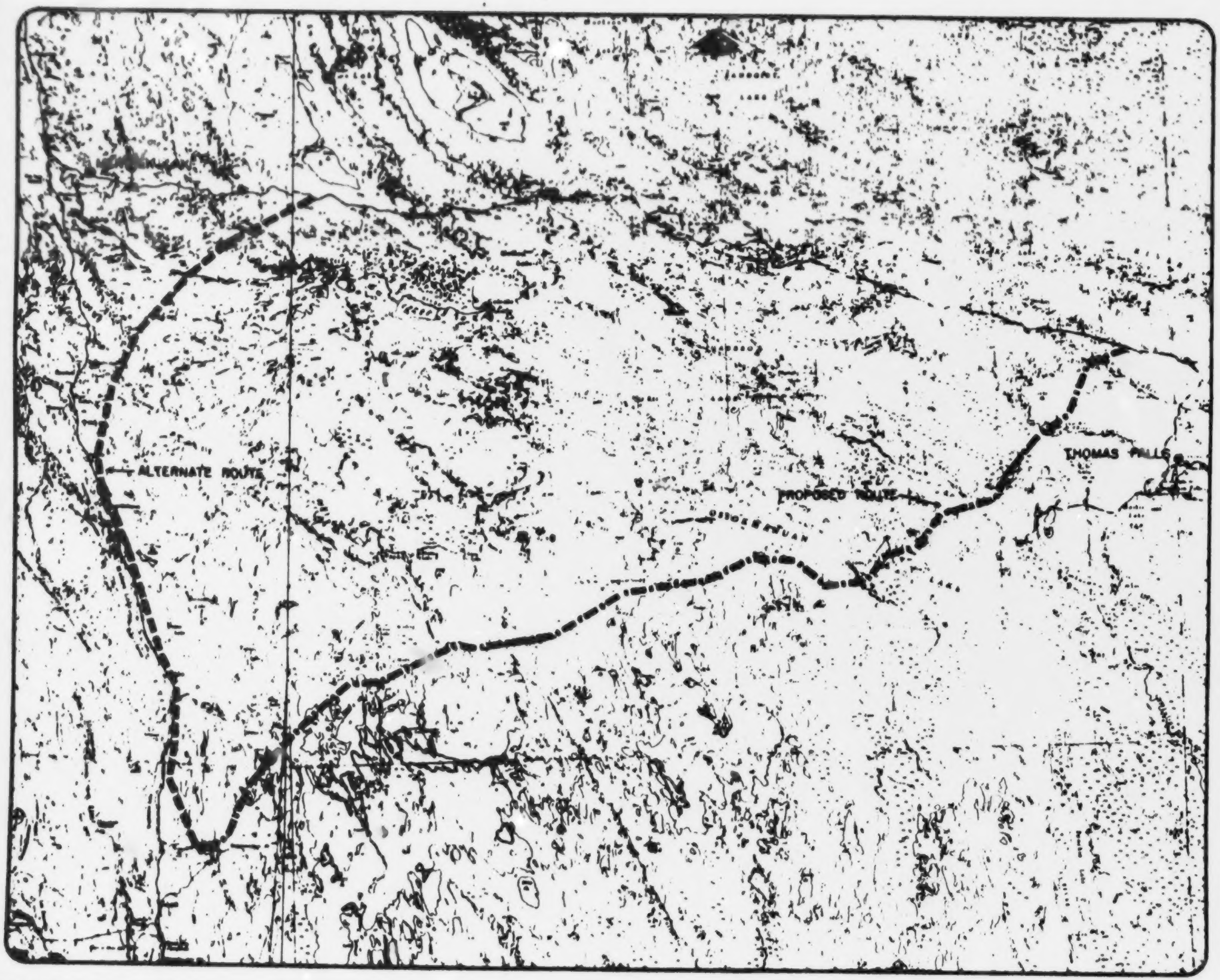
Co-ordinates: 53°26'N 64°18'W

Status: Special Site.

Size: 0.7 km^2.

Description: A complex forest and fen developed under the influence of the spray from Churchill Falls so that there are great differences over short distances.

Approximate distance from road corridor: 15 km.


ALTERNATE ROUTE
PROPOSED ROUTE
THOMAS FALLS

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

● I.B.P. SITES

Figure E.4.6-1. Location Of I.B.P. Sites Adjacent To Proposed And Alternate Routes

SCALE 1:400,000

DATE:

CONSULTANT: Northland Associates

TRANSPORTATION

E.5 Impacts (Vegetation/Soils)

An evaluation of the sensitivity of terrain and vegetation in the two corridors must take into consideration the fact that primary disturbance has already occurred in much of the alternate corridor because of the earlier construction of the railway. Additional disturbance of the land base from construction of the tote road can be minimized by using the existing avenues of access and by confining (as much as possible) construction activities to the previously disturbed corridor. No such option is available along the proposed route, which is located in previously undisturbed wilderness. All of the access and staging (eg. vehicle turning, storage) requirements necessary to support the construction program will have to be newly created.

Impacts on vegetation are difficult to assess without a conjoint assessment of impacts on terrain; vegetation and terrain are largely inseparable since vegetation stabilizes the terrain and terrain in turn provides a growing medium for vegetation.

The vegetation present along the corridors has adapted to three major classes of genetic material (Section E.1.1). These materials are morainal deposits with moderately fine to coarse textures, glaciofluvial deposits with moderately coarse to very coarse textures, and colluvial deposits with textures varying from clay to rubble. Generally speaking, soils along both routes are therefore relatively stable. However, some construction problems may be anticipated where near-vertical faces are encountered in glaciofluvials, for example, crossing esker slopes or eroded (gullied) glaciofluvial terraces.

Road construction requires large quantities of fill, and vegetation disturbance and removal consequently results from such activities. The severity of the impacts will vary according to the nature of the vegetation and terrain disturbed and the specific construction activities being carried out.

Changes in drainage patterns and resulting fluvial erosion represent a concern for construction along either route. In areas dominated by finer texture materials and steep topography, removal of vegetation will tend to accelerate erosion. Natural succession of the vegetation communities on such terrain may be difficult since erosional rates may occur more rapidly than rates of vegetation re-establishment. Soil nutrient losses from leaching would also hinder re-establishment of natural successional trends. Scrub forests occupying nutrient-poor sites will probably change into a barren type after extensive disturbance by cutting or fire. However, the disturbance resulting from road construction alone would not likely be extensive enough to cause the change to barrens. Even if such a change were to occur, the new types occupying the disturbed site should not be more environmentally sensitive than the original type.

Road construction through the productive forest stands on the proposed route will not adversely affect the remaining resource. However, some edge effect (eg. possible blowdown) along the cut right-of-way can be expected.

Aeolian erosion can be expected to be more localized than fluvial erosion. Areas subject to erosive processes from wind action would be concentrated on level topography with a predominance of fine-textured material. Between kilometre 68 and 70 on the proposed route, aeolian erosion is evident on moderately fine textured glaciofluvial and morainal deposits. These areas were disturbed by access road construction and also appear to have been burned prior to (or during) the construction phase.

Soil nutrient losses will occur in areas affected by wind erosion. The exposure of these soils in combination with their fine textures would cause heavy nutrient loss due to leaching. This nutrient loss could be expected to hinder re-establishment of vegetation and subsequent soil stabilization.

Where fine textured materials are encountered along the route, stabilization measures will have to be initiated immediately to ensure wind and water erosion does not take place. Stabilization of soils and re-establishment of vegetation cover should be considered a priority on steep slopes where the soils are fine-textured. Without this preventative measure, washout of road beds is a distinct possibility, particularly if vegetation removal is excessive.

Organics along both the proposed and alternate routes will be affected by road construction. Where these types occur along the right-of-way, excavation of the organic soil (depths vary from 1 to 3 metres) will be required. Road bed construction through these types will undoubtedly interrupt the natural drainage system and care will have to be taken to ensure adequate drainage. If drainage is impeded, the string bogs may change to a marsh vegetation type, lateral seepage can be expected and could affect road bed stability during spring runoff. If drainage is accelerated, the bogs may change to a barren type vegetation.

When possible, road alignment should occur above major organic deposits rather than below them in order to decrease the interference with natural drainage patterns. Wetlands have a great ability to retain excess runoff and precipitation, especially during flood periods. By draining or disturbing these communities, natural reservoirs for flood waters are also removed causing a great increase in the amount of fluvial erosion and consequent damage to the road.

E.6 Comparison of Proposed and Alternate Routes

The potential for geomorphology/soils/vegetation to affect, and be affected by, road construction along each route will be briefly examined in this section.

Generally, the geomorphology/soils/vegetation is similar on each route: soils are relatively stable, the vegetation is typical of the extensive Boreal forest region and not known to contain any unique or rare elements, and the landforms are basically the same. No substantial negative impacts would be expected regardless of which route is chosen. However, because the proposed route passes through undisturbed territory, the potential for disturbance to the land base from this tote road construction is greater for the proposed route than for the previously disturbed alternate route.

A consideration of the forest resource of the area reveals that the proposed route contains some stands of productive forest and that the alternate route does not. However, selection of the proposed route would neither jeopardize nor encourage the establishment of a forest-based industry (eg. pulp and paper, sawlogs) for the area because overall timber volumes are well below those required for such a venture. The proposed route could, however, have a positive effect by providing access to a better firewood resource than is presently available locally.

The presence of better forest stands on the proposed route (compared with the alternate route) has both positive and negative connotations. Reducing the size of these stands (through right-of-way cutting and subsequent firewood harvesting) will reduce their value as potential cover and winter range for caribou, and the removal of shade trees from the edge of waterways will possibly eliminate some spawning habitat for particular fish species (eg. salmonids). Also, the increased use of the proposed route for firewood cutting and for recreation (it is a wilder area containing more fish and game than the partially disturbed alternate route) increases the potential for man-caused fires, which would further reduce the fish and wildlife habitat for some species.

On the positive side, opening up the productive forest stands would, in addition to providing access to firewood, create improved habitat for such wildlife species as moose and various small/upland game which prefer the early stages of succession which follow forest thinning.

To comment further on the fishery resource, the fact that the proposed route crosses more major streams than the alternate route suggests that the proposed route presents the greater potential for damage to fishery habitat. This, of course, may be viewed from the other perspective: the proposed route provides access to better fishing, thus boosting the recreational potential of western Labrador both for the tourst and local resident.

This same argument can be advanced to suggest that the proposed route will provide better hunting and trapping opportunities to local residents (including native peoples) than would selection of the alternate route with its suspected lower potential for game.

The mineral potential of the area is not considered to be very great, but difficulty of access has limited exploration activity in the past and closer scrutiny may prove to be worthwhile. Selection of either the proposed or alternate route would likely have a positive effect; an increase in the level of such activity.

Socio-economic benefits have, for the most part, been discussed as part of the examination of other subject areas earlier in this section.

In summary, and within the context of the NORTHLAND study components, neither route has a major and obvious advantage over the other in terms of potential for environmental impact. However, the presence of productive forest stands and an undisturbed land base on the proposed route, and the implications and consequences of clearing a right-of-way through this area (habitat disturbance, fire) suggests that this route has a somewhat greater potential for negative environmental impact.

E.7 Recommendations

Geomorphology - Soils - Vegetation

The evaluation of geomorphic and soil units, as well as vegetation, was completed using 1:50,000 scale aerial photography. There is a possibility that negative environmental impacts will result from road construction through glacio-fluvial ecosystems particularly where near vertical slopes are encountered.

It is recommended that a reconnaissance survey be carried out to provide ground truth data (soils and vegetation) for those specific areas along the proposed and alternate routes where these landforms occur.

ECOSYSTEM LEGEND

Topography

F - Flat
U - Undulating
R - Rolling
H - Hilly

Depth of Material

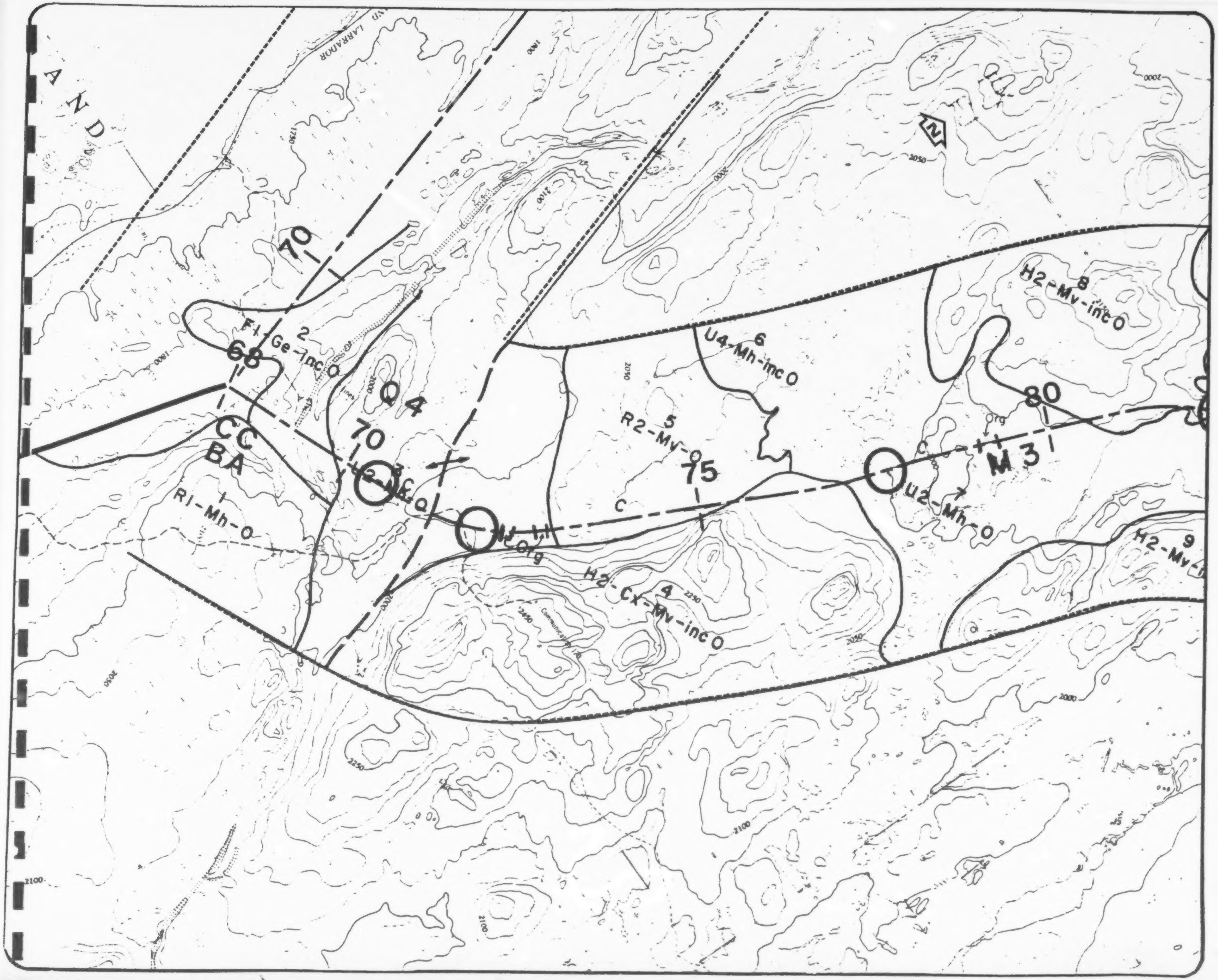
1 - Deep > 3m. of material
2 - Deep and Shallow
3 - Deep and Bare
4 - Shallow and Deep
5 - Shallow > 3m. of material
6 - Shallow and Bare
7 - Bare and Deep
8 - Bare and Shallow
9 - Bare 10cm of material

Genetic Categories

M - Morainal Deposits
G - Glaciofluvial Deposits
C - Colluvial Deposits
O - Organic Deposits
R - Rock

Morphologic Modifiers

(d) Drumlinoid
(h) Hummocky
(v) Veneer
(x) Complex
(r) Ridged


AND
LABRADOR
70
68
F1-Ge-inc O
2
Q4
70
CC
BA
R1-Mh-O
Org
H2-Cx-Mv-inc O
4
Communication
R2-Mv-O
5
U4-Mh-inc O
6
75
C
U2-Mh-O
80
Org
M3
H2-Mv-inc O
8
H2-Mv-
9
N
1800
2000
2050
2100
2250
2450

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP

BA BORROW AREA

MD MAINTENANCE DEPOT

○ RIVER CROSSING

B BRIDGE

KILOMETRES FROM WABUSH

C CULVERTS

$\frac{\psi}{Org}$ ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-1

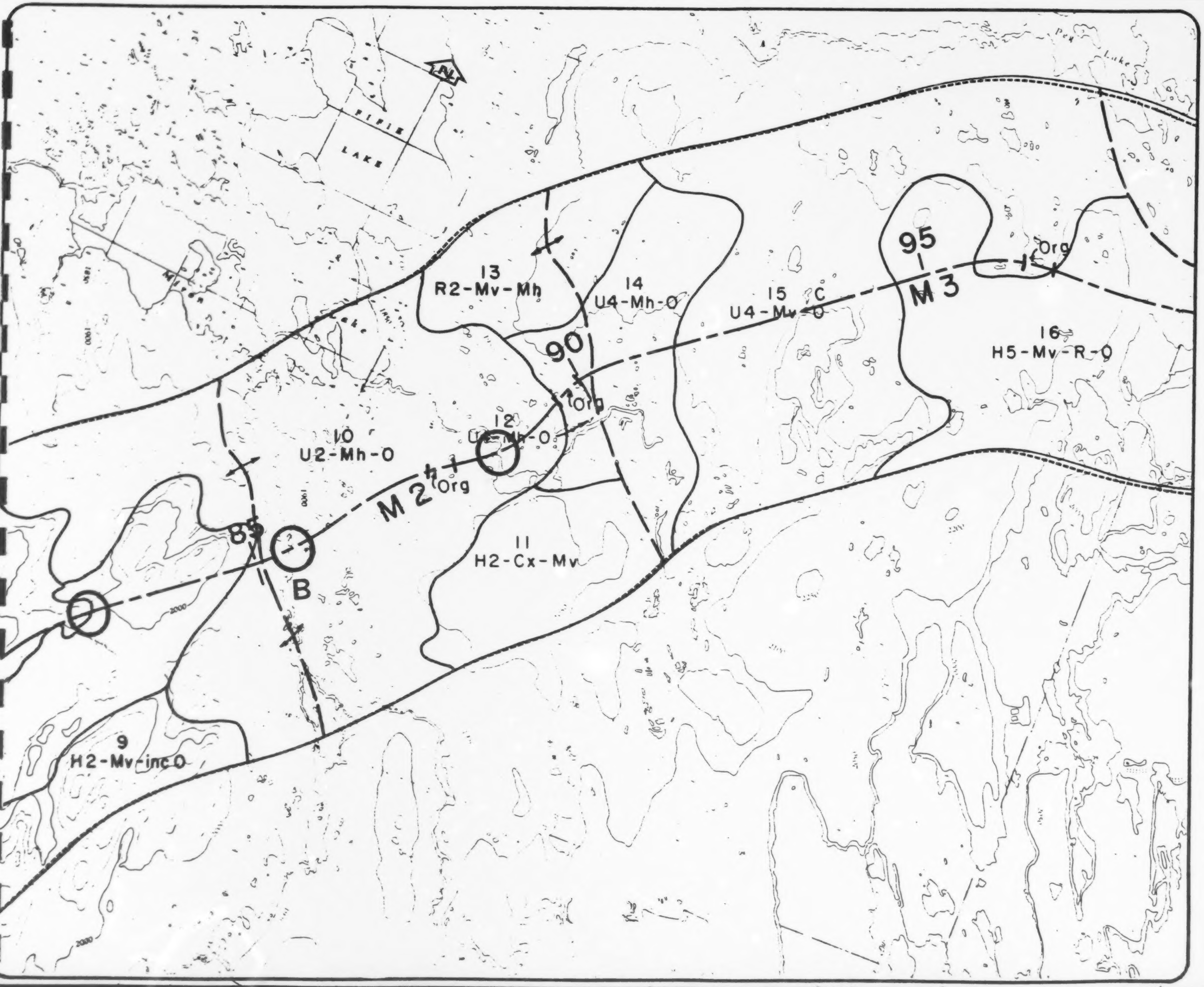
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


N
FIFIE
LAKE
13
R2-Mv-Mh
14
U4-Mh-O
15
C
U4-Mv-O
95
M3
Org
16
H5-Mv-R-O
90
Org
12
U4-Mh-O
10
U2-Mh-O
M2
Org
85
B
11
H2-Cx-Mv
9
H2-Mv-inc O
2000

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
⁄⁄ Org	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-2

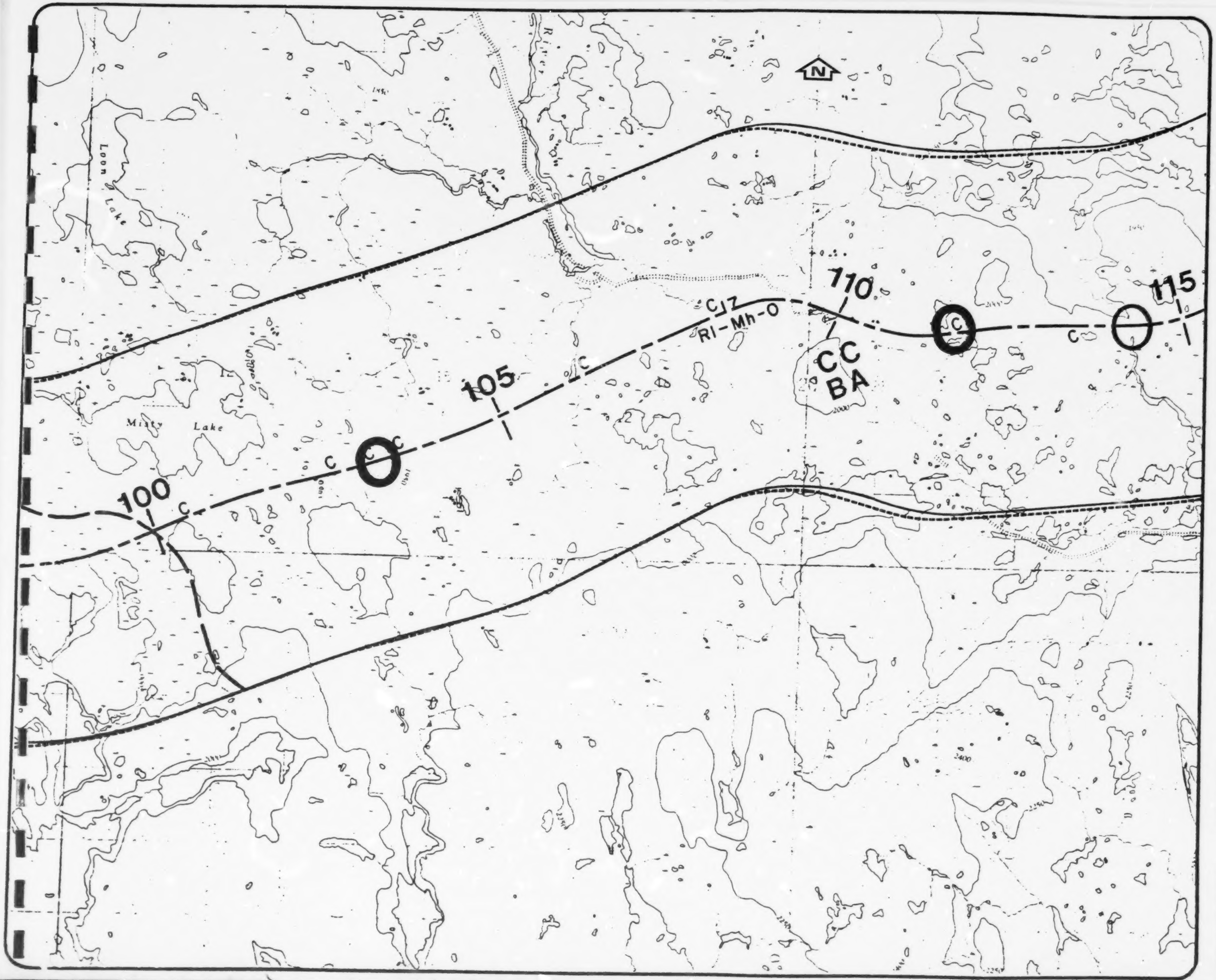
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986 /02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


N
River
Loon Lake
Misty Lake
100
C
C
C
C
105
C
C
RI-Mh-O
110
CC
BA
C
C
115

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
$\frac{\not{+}}{Org}$	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

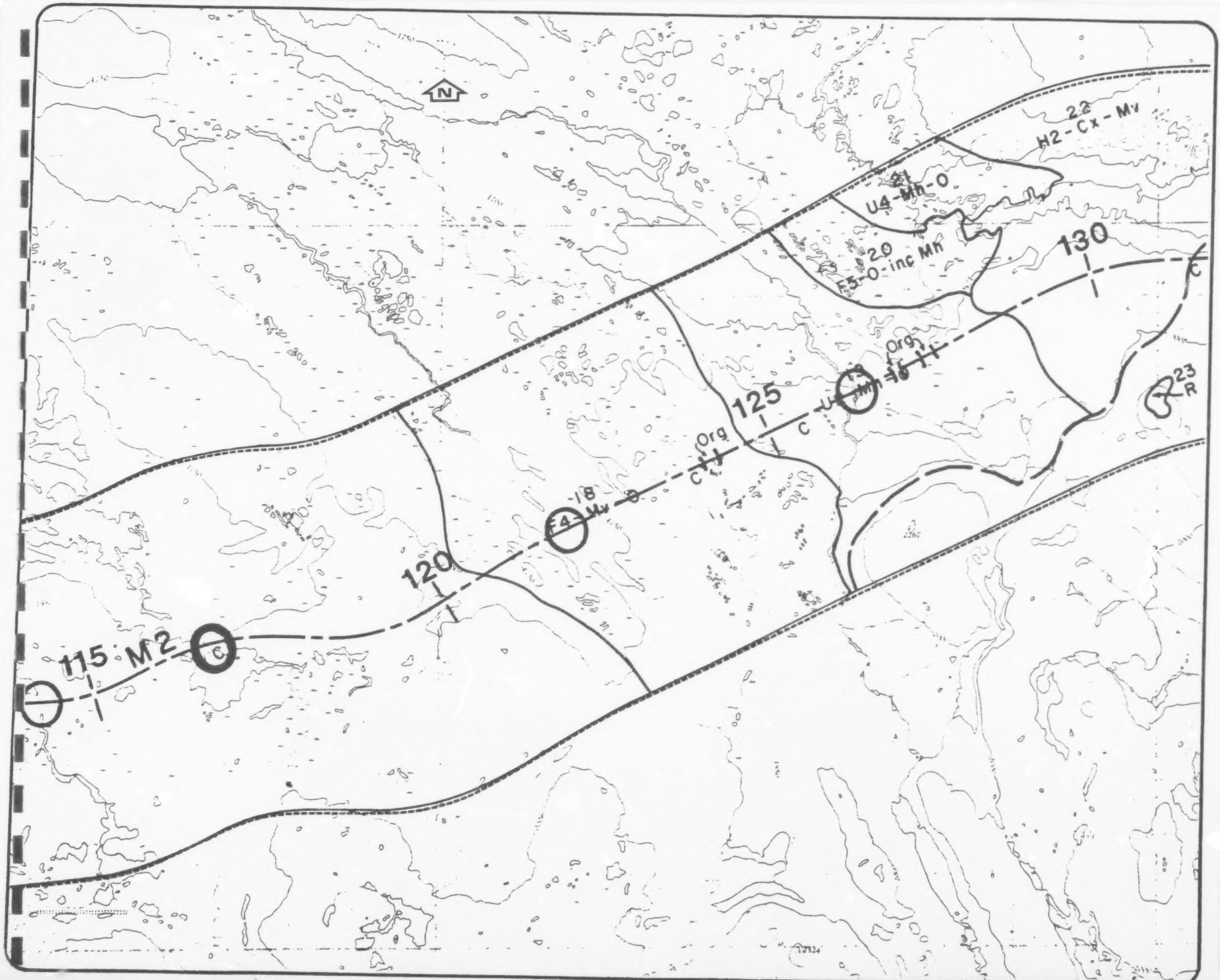
MAP E-3

SCALE 1:50,000
1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


N
22
H2-Cx-Mv
21
U4-Mh-O
20
E5-O-inc Mh
130
C
Org
19
U-Mh
125
C
Org
C
18
E4-Mv-O
120
115
M2
C
23
R

ROSS BAY JUNCTION-CHURCHILL FALLS
TOTE ROAD
ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
$\frac{\text{/-/}}{\text{Org}}$	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

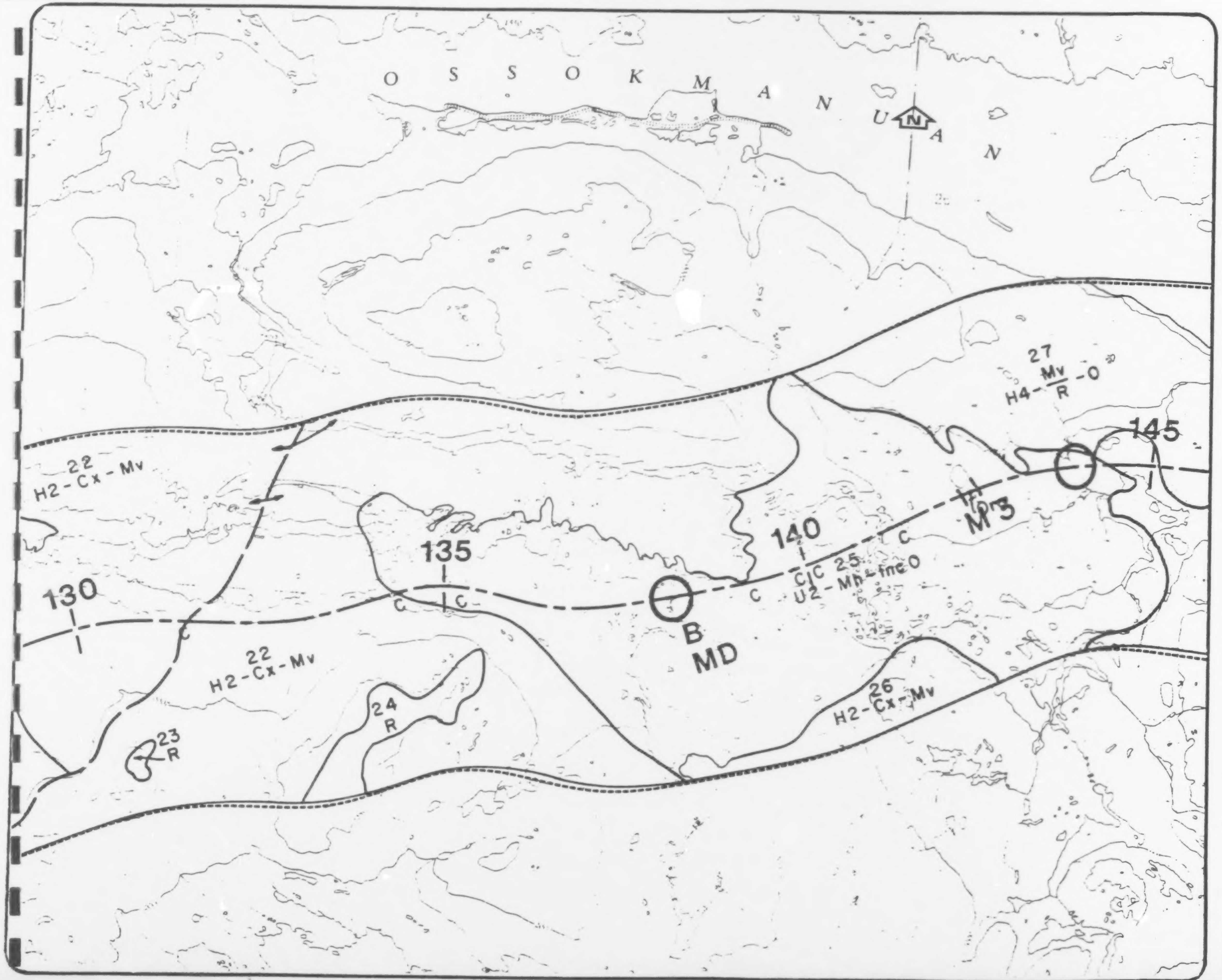
MAP E-4

SCALE 1:50,000
1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


OSSOKMANUAN
N
22
H2-Cx-Mv
130
135
140
145
C
B
MD
C/C 25
U2-Mh-fnc O
M3
27
H4-Mv/R-O
22
H2-Cx-Mv
23
R
24
R
26
H2-Cx-Mv

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
$\frac{/\!/}{Org}$	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-5

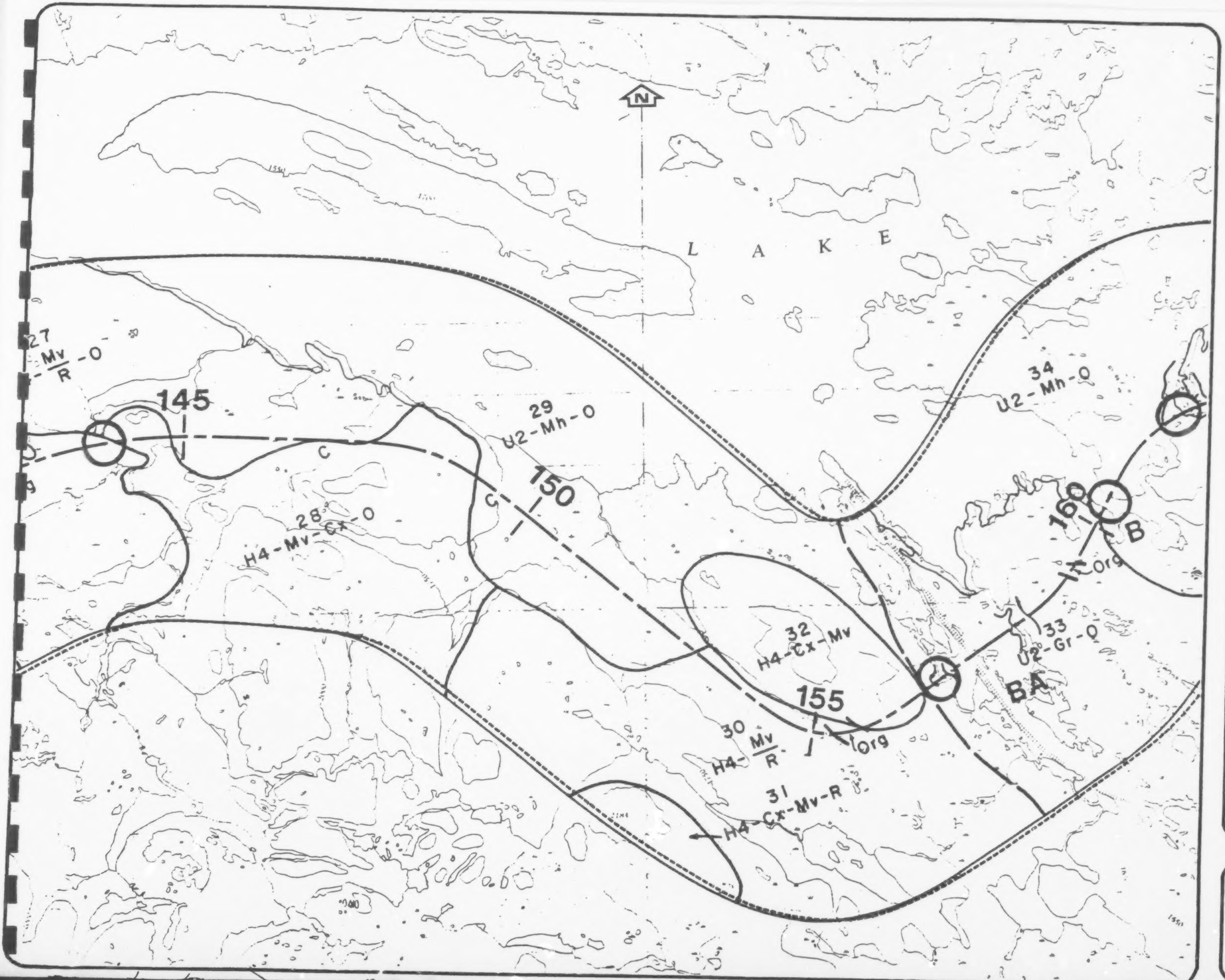
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION



27
Mv/R - O
145
29
U2-Mn-O
C
C
150
28
H4-Mv-Cx-O
L A K E
34
U2-Mn-O
160
B
Org
33
U2-Gr-O
BA
32
H4-Cx-Mv
155
Org
30
H4-Mv/R
31
H4-Cx-Mv-R

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
KILOMETRES FROM WABUSH
C CULVERTS
$\frac{/\!\!/}{Org}$ ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

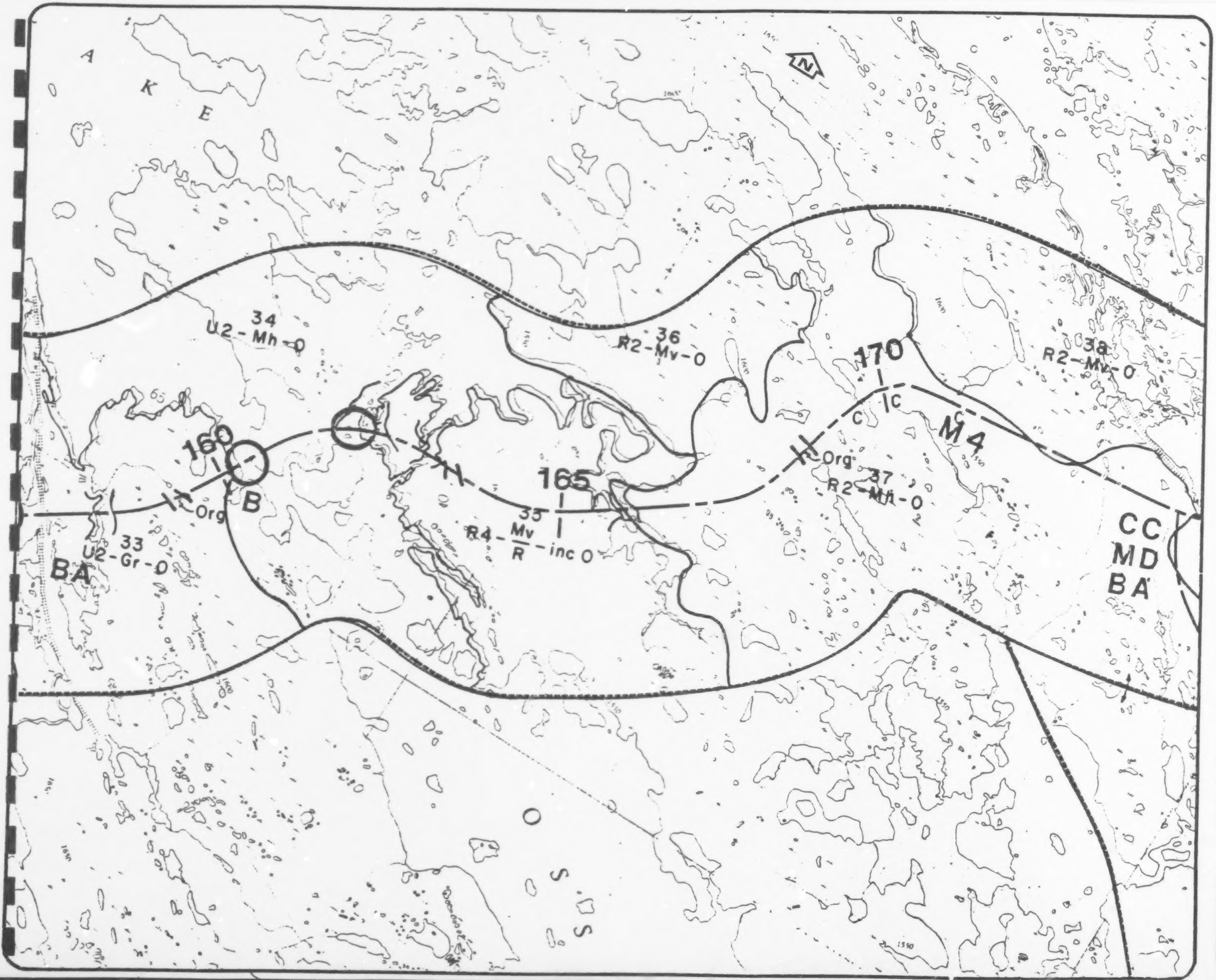
MAP E-6

SCALE 1:50,000
1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


A K E
34
U2-Mh-O
36
R2-Mv-O
38
R2-Mv-O
170
160
165
C
C
C
M4
B
Org
Org
33
U2-Gr-O
BA
35
R4 - Mv/R - inc O
37
R2-Mh-O
CC
MD
BA
O
S
S
N

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC CONSTRUCTION CAMP

BA BORROW AREA

MD MAINTENANCE DEPOT

○ RIVER CROSSING

B BRIDGE

# KILOMETRES FROM WABUSH

C CULVERTS

$\frac{/\!\!/}{Org}$ ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-7

SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

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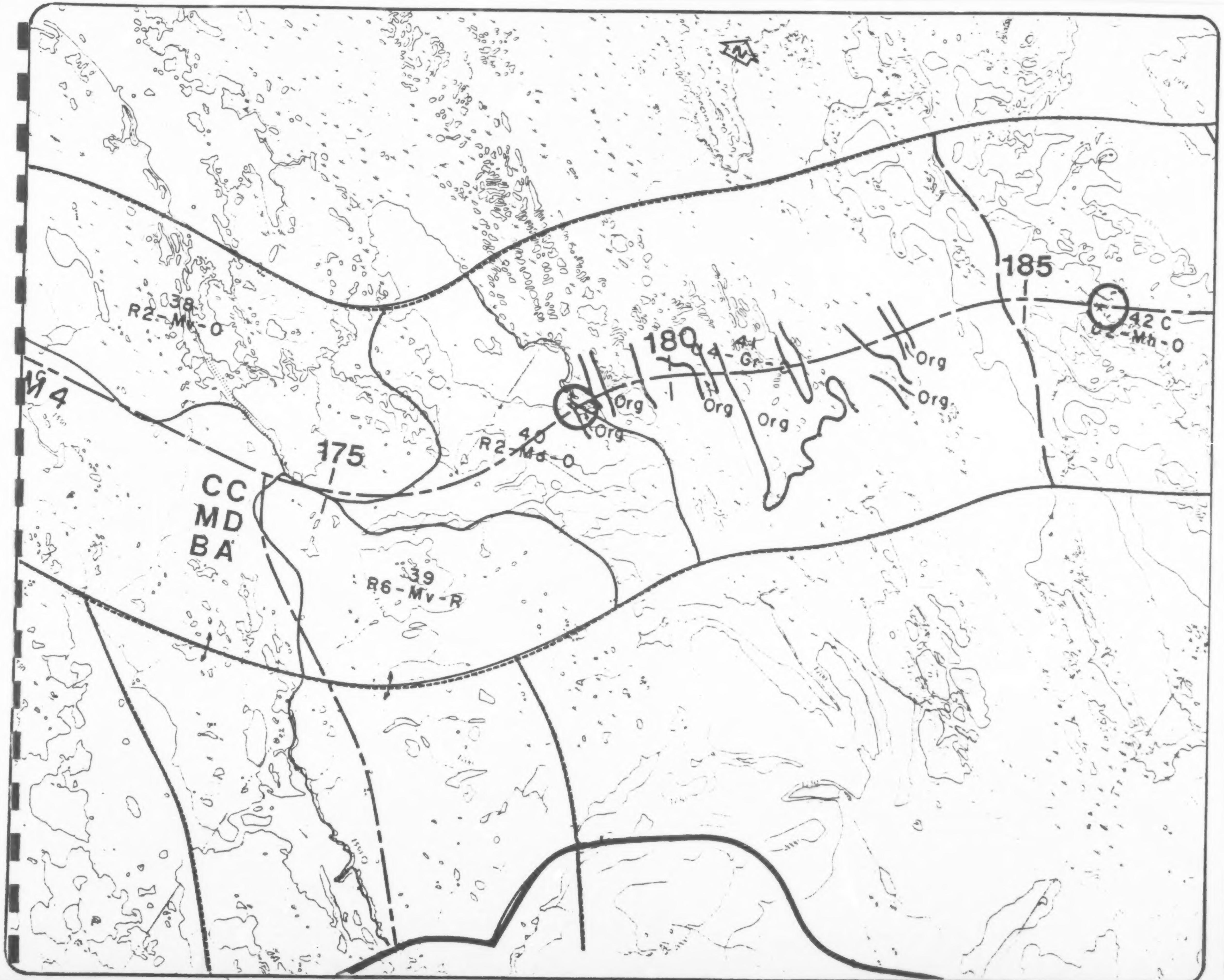

N
38
R2-Mv-O
14
175
CC
MD
BA
40
R2-Md-O
180
41
G4-Gr
Org
Org
Org
Org
Org
Org
Org
185
42 C
O2-Mh-O
39
R6-Mv-R

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

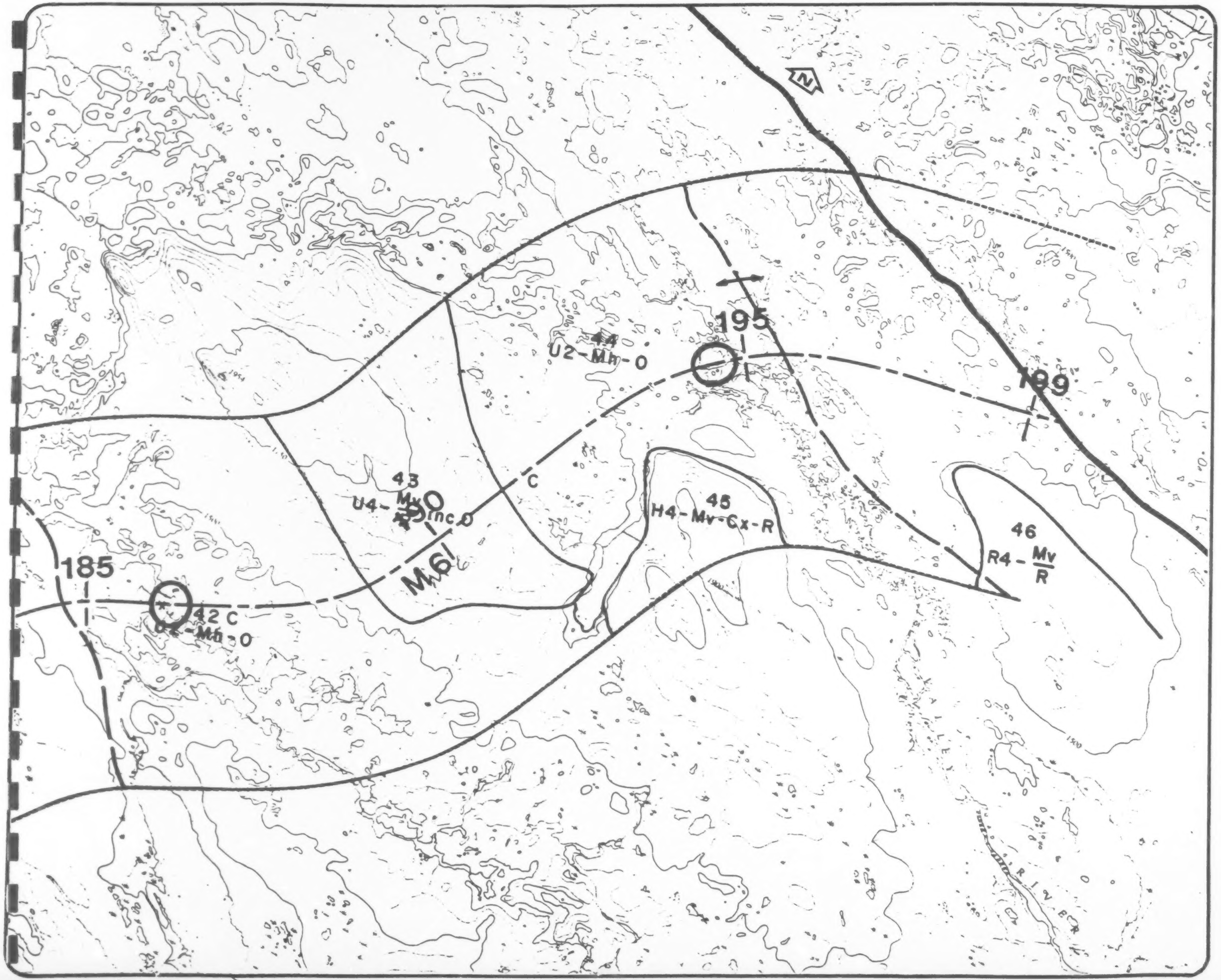
PROPOSED ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
KILOMETRES FROM WABUSH
C CULVERTS
$/\!\!/_{Org}$ ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-8

SCALE 1:50,000
1000 500 0 1000 METRES
DATE: 1986/02
CONSULTANT: NORTHLAND ASSOC. LTD.
TRANSPORTATION


N
185
42 C
U2-Mh-O
43
U4-Mv
inc.O
C
M61
44
U2-Mh-O
195
199
45
H4-Mv-Cx-R
46
R4-Mv/R
VALLEY
RIVER

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
$\frac{\psi}{}_{Org}$	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-9

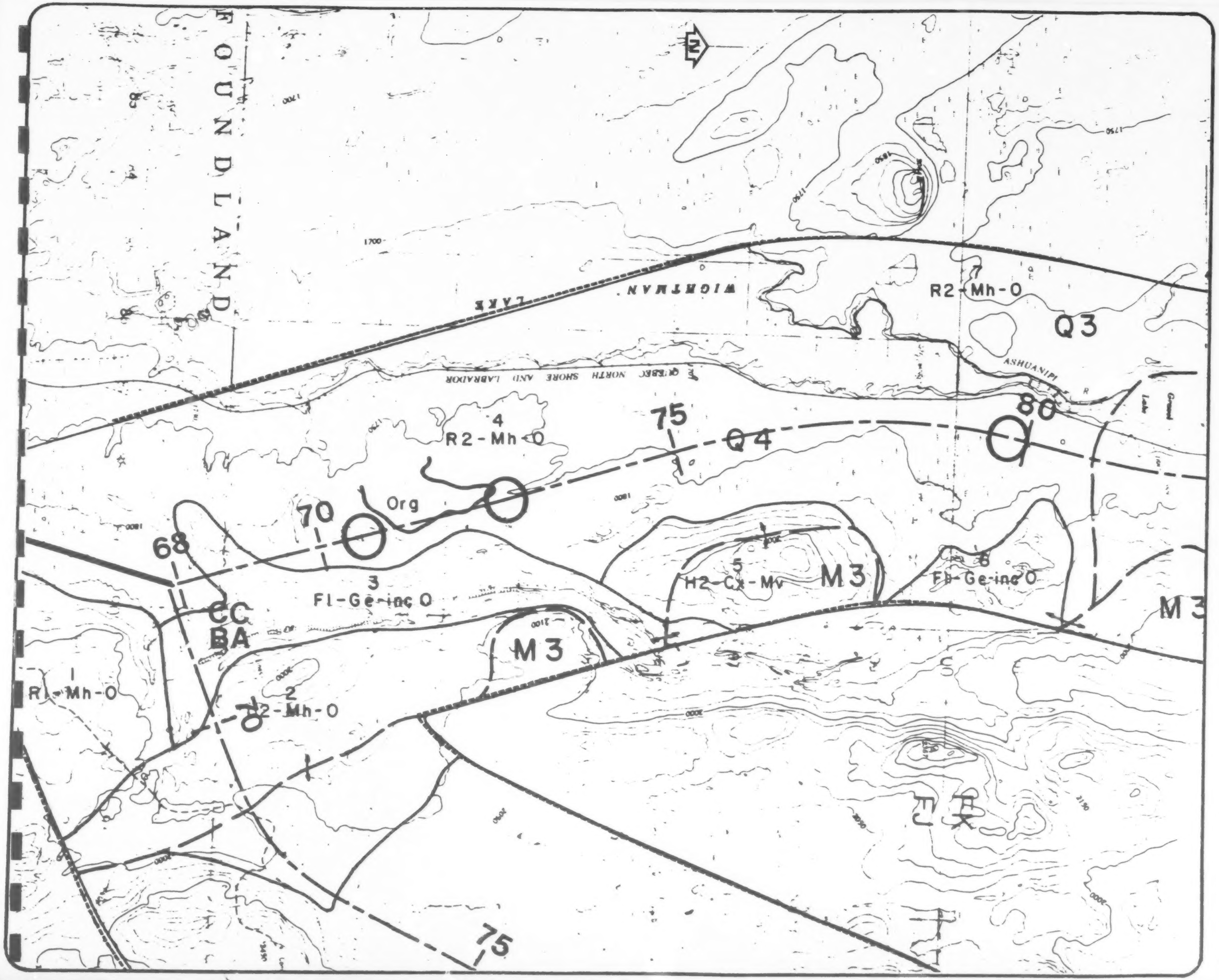
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


N
FOUNDLAND
WIGHTMAN LAKE
QUEBEC NORTH SHORE AND LABRADOR
ASHUANIPI R.
Grand Lake
1700
1750
1800
2000
2100
7
R2-Mh-O
Q3
4
R2-Mh-O
75
Q4
80
70
Org
68
3
Fl-Ge-inc O
CC
BA
M3
5
H2-Cx-Mv
M3
6
Fl-Ge-inc O
M3
1
R1-Mh-O
2
R2-Mh-O
70
75
FJ
FX

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
$/_{Org}$	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-1

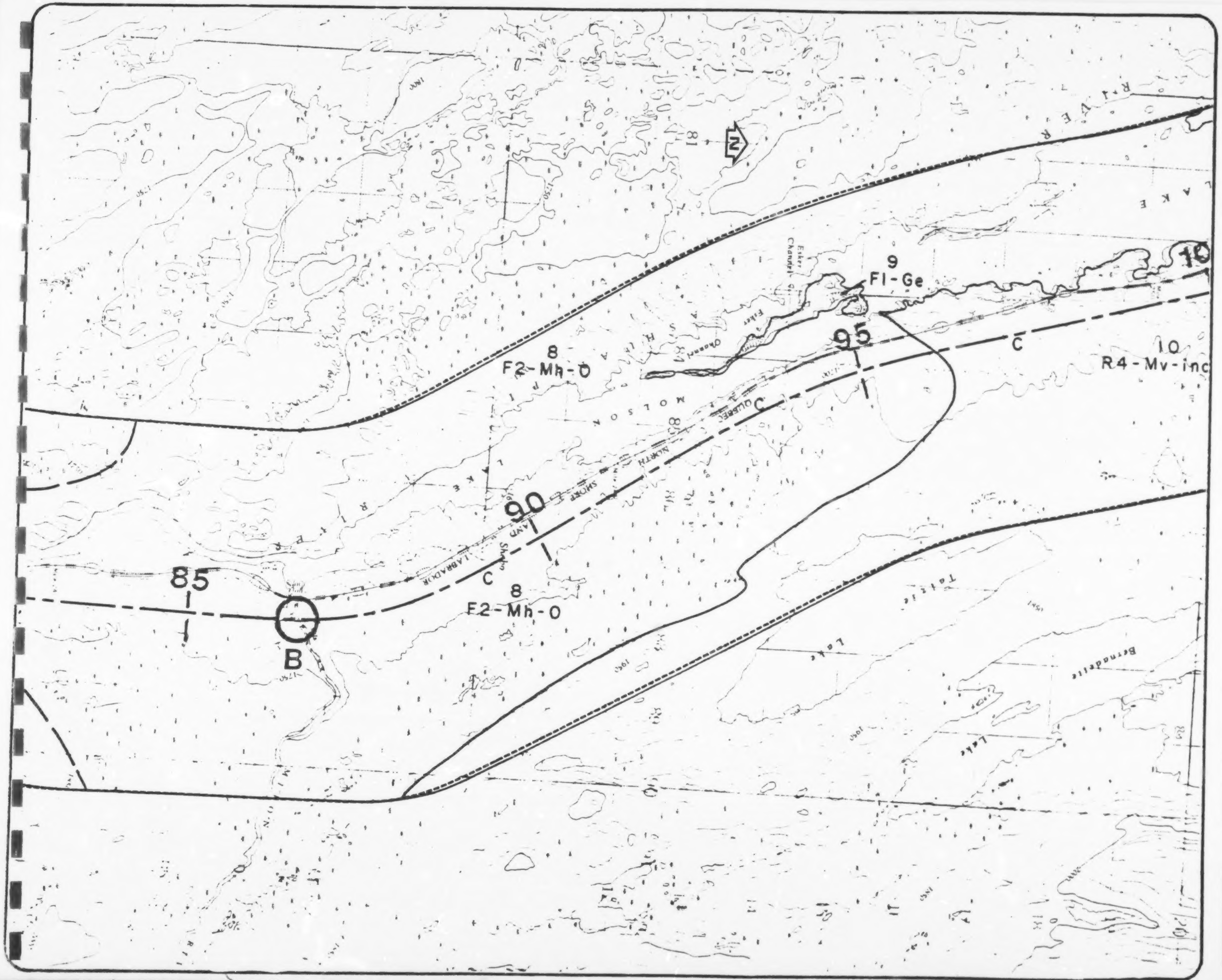
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


85
90
95
10
B
C
8
F2-Mh-0
9
F1-Ge
10
R4-Mv-inc
MOLSON
LAKE
RIVER
NORTH SHORE AND LABRADOR
QUEBEC
Tatie Lake
Bernadette Lake

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
+/Org	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-2

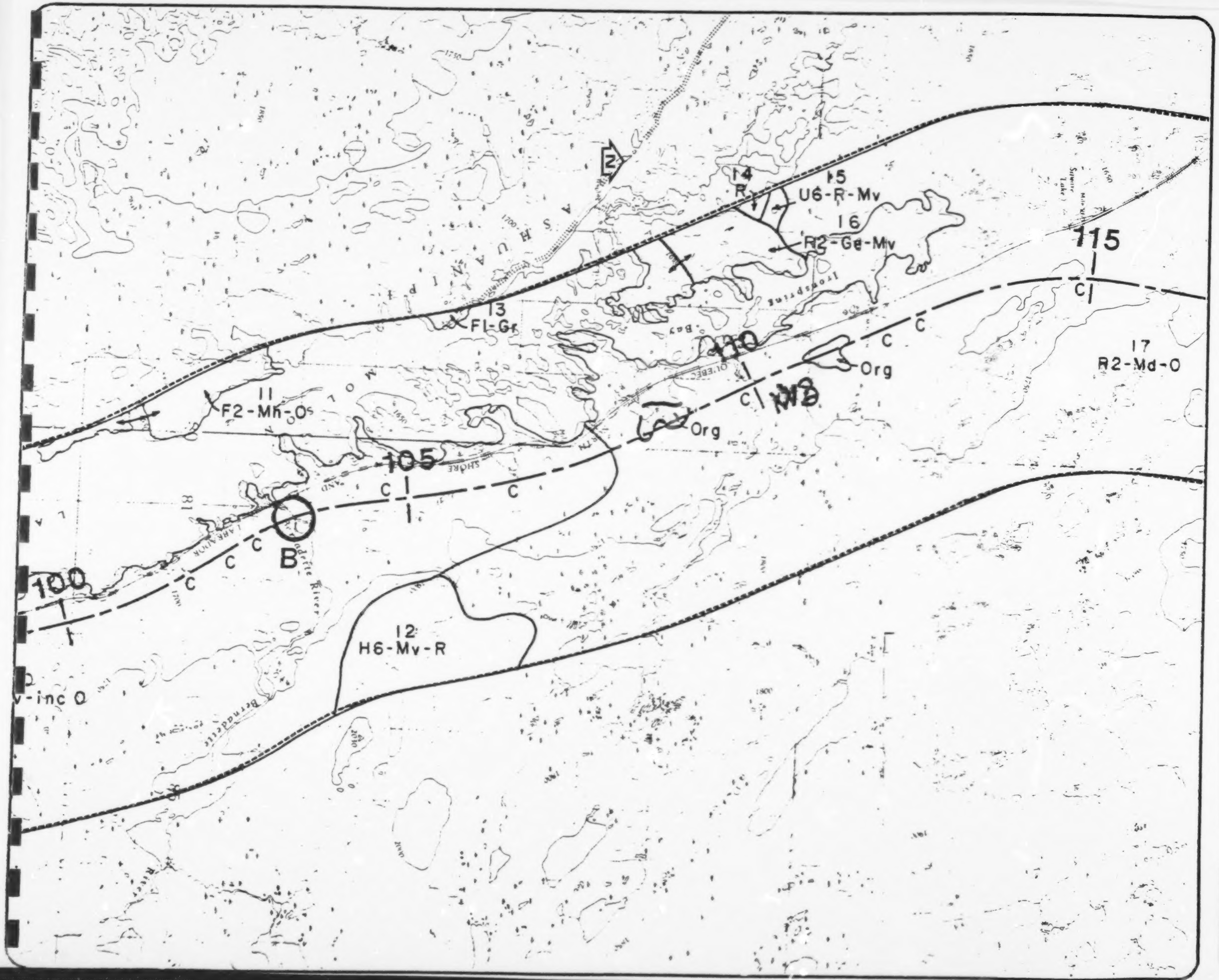
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


2
14
R
15
U6-R-Mv
16
R2-Ge-Mv
115
C
13
Fl-Gr
110
C
C
C
Org
17
R2-Md-O
11
F2-Mn-Os
C
MD
Org
105
C
C
B
100
C
C
C
12
H6-Mv-R
v-inc O

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

- CC CONSTRUCTION CAMP
- BA BORROW AREA
- MD MAINTENANCE DEPOT
- ○ RIVER CROSSING
- B BRIDGE
- # KILOMETRES FROM WABUSH
- C CULVERTS
- $/\!\!+\!\!/_{Org}$ ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-3

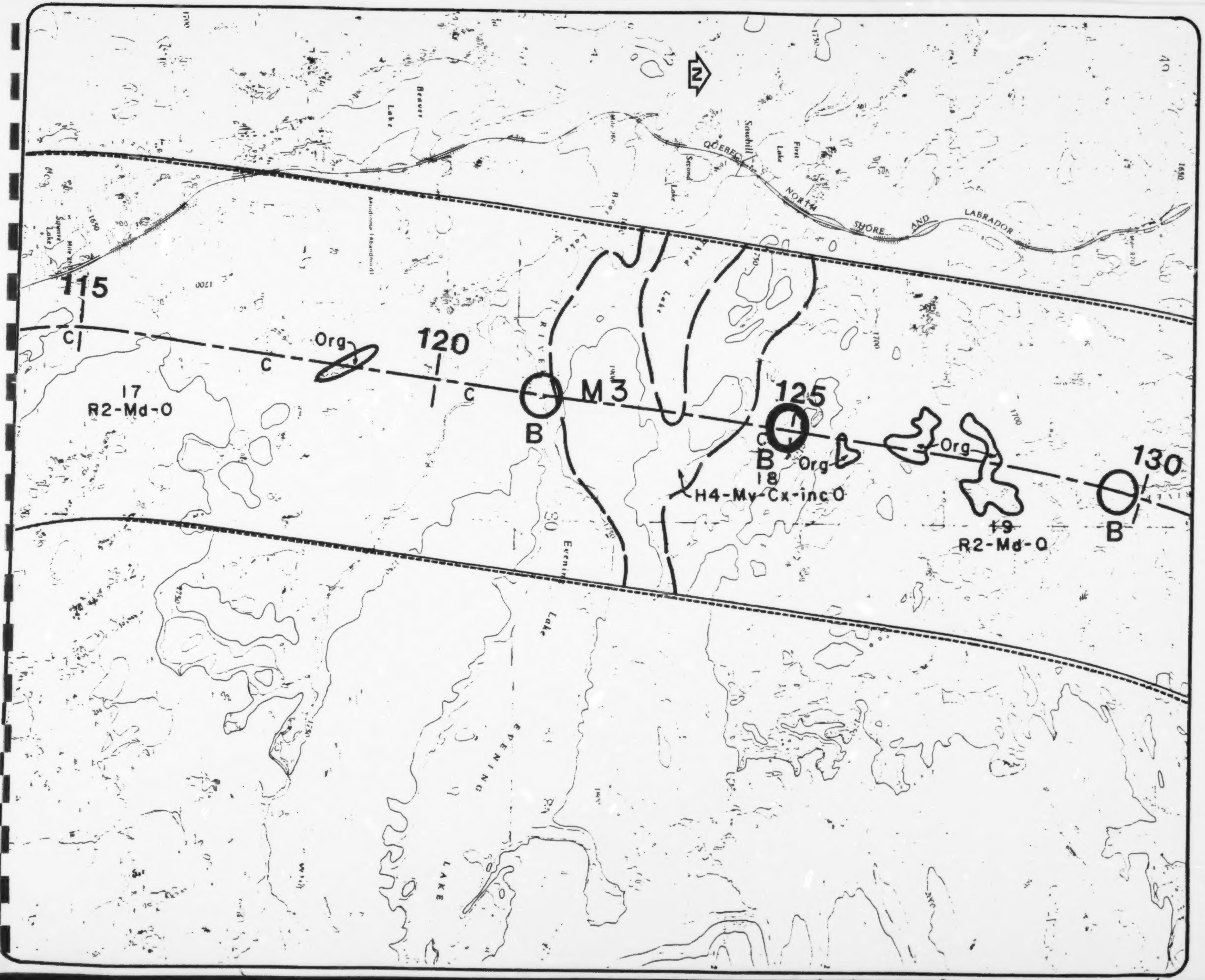
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


N
115
120
125
130
C
C
C
C
Org
Org
Org
M3
B
B
B
17
R2-Md-O
18
H4-Mv-Cx-incO
19
R2-Md-O
QUEBEC NORTH SHORE AND LABRADOR
Beaver Lake
Second Lake
First Lake
Evening Lake
EVENING LAKE
1700
1750
1650

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
Org	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-4

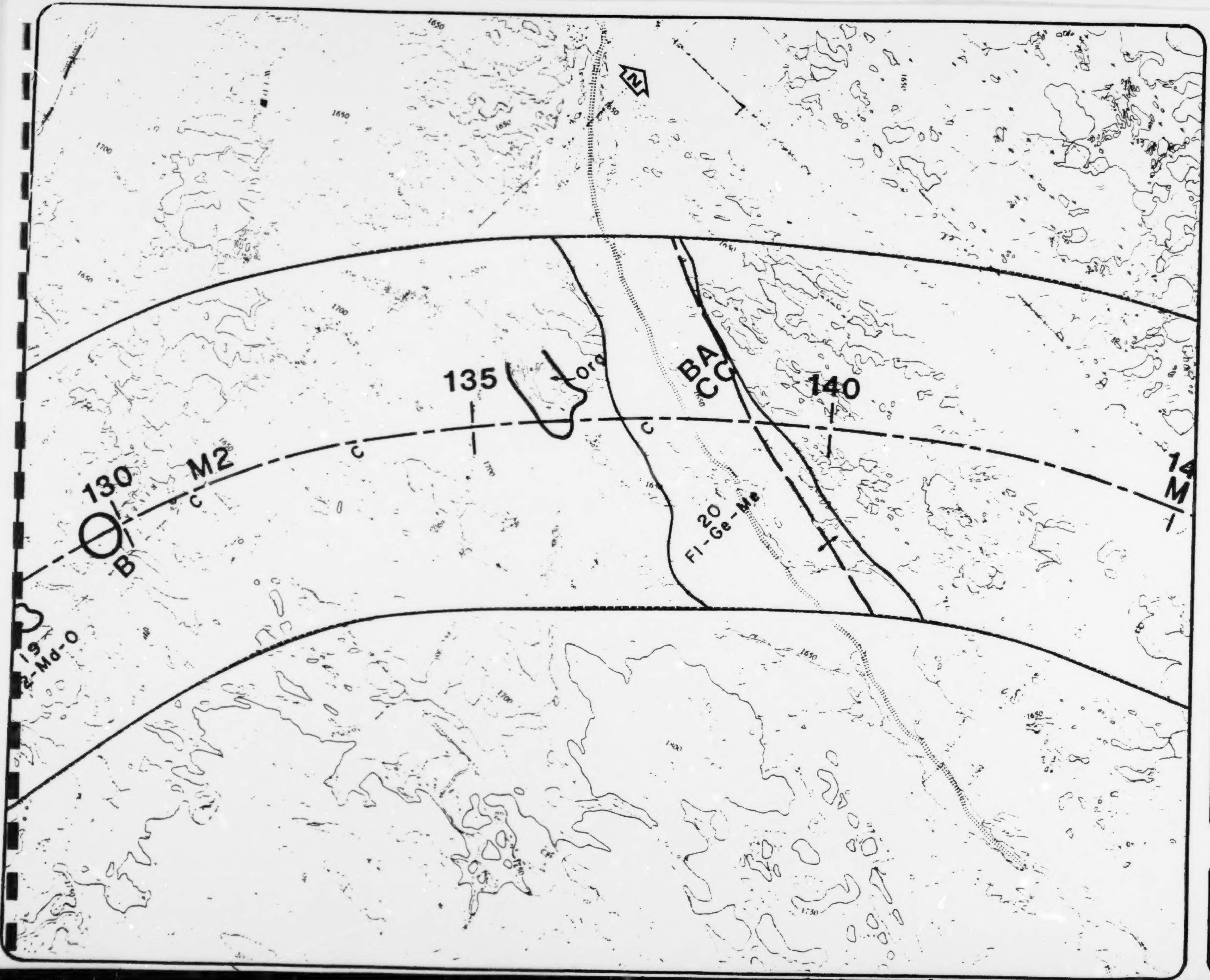
SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION


1650
1700
1750
130
135
140
14
M2
M
B
C
BA
CC
Org
20
Fl-Ge-Me
19
-Md-O
N

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

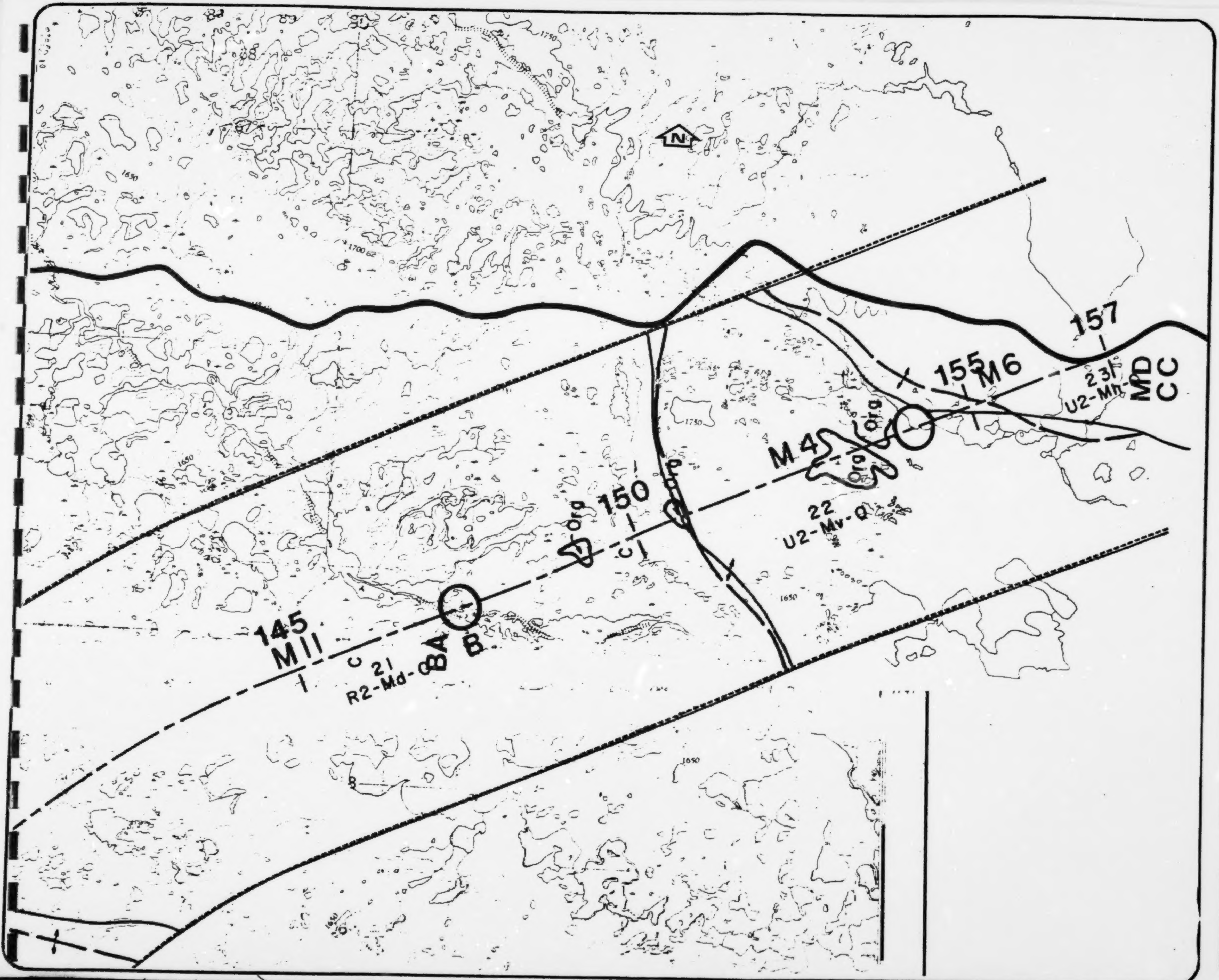
ALTERNATE ROUTE

CC CONSTRUCTION CAMP
BA BORROW AREA
MD MAINTENANCE DEPOT
○ RIVER CROSSING
B BRIDGE
KILOMETRES FROM WABUSH
C CULVERTS
Org ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-5

SCALE 1:50,000
1000 500 0 1000 METRES
DATE: 1986/02
CONSULTANT: NORTHLAND ASSOC. LTD.
TRANSPORTATION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N
1650
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157
155
M6
23
U2-Mh-
MD
CC
M4
Org
150
C
22
U2-Mv-Q
1650
145
M11
C
21
R2-Md-Q
BA
B
1650

ROSS BAY JUNCTION-CHURCHILL FALLS

TOTE ROAD

ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATE ROUTE

CC	CONSTRUCTION CAMP
BA	BORROW AREA
MD	MAINTENANCE DEPOT
○	RIVER CROSSING
B	BRIDGE
#	KILOMETRES FROM WABUSH
C	CULVERTS
Org	ORGANICS

NOTE: FOR ECOSYSTEM LEGEND REFER TO P.62, APPENDIX E.

MAP E-6

SCALE 1:50,000

1000 500 0 1000 METRES

DATE: 1986/02

CONSULTANT: NORTHLAND ASSOC. LTD.

TRANSPORTATION

Appendix "F"

DEPARTMENT OF TRANSPORTATION GENERAL SPECIFICATION

NEWFOUNDLAND
Department of
Transportation

DIVISION 1

SPECIFICATIONS GENERAL

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Department of
Transportation
NEWFOUNDLAND

SECTION 140

PROTECTION OF INLAND FISHERIES ENVIRONMENT

All permanent or temporary works or undertakings which are proposed for watercourses or water bodies constituting fish habitat require authorization from the Habitat Protection Branch of the Federal Department of Fisheries and Oceans prior to the commencement of any work. The Contractor is required to obtain such approval.

Application forms for authorization for works or undertakings affecting fish habitat are available at all Department of Fisheries and Oceans Offices located at St. John's, Marystown, Grand Falls, Goose Bay and Corner Brook.

Contractors are advised that Environmental and Fisheries regulations require that any work done in or near a river must be restricted to the minimum disturbance in the waterway. Great care must be taken not to dispose of any material into or near the river which could be harmful to the fish habitat (Fisheries Act, Paragraph 33.1). Culvert pipes must be constructed or laid to allow free movement of fish, which requires that the bottom of the structure be at least 300 mm below the river bed. (Copy of Paragraph 33.1 Follows).

33.1

(1) Every person who carried on or proposes to carry on any work or undertaking that results or is likely to result in

(a) the deposit of a deleterious substance in water frequented by fish or in any place under any conditions where that deleterious substance or any other deleterious substance that results from the deposit of that deleterious substance may enter any such water, or

(b) the alteration, disruption or destruction of fish habitat, shall, on the request of the Minister or without request in the manner and circumstances prescribed by regulations made under paragraph (3) (a) provide the Minister with such plans, specifications, studies, procedures, schedules, analyses, samples or other information relating to the work or undertaking and with such analyses, samples, evaluations, studies or other information relating to the water place or fish habitat that is or is likely to be affected by the work or undertaking as will enable the Minister to determine

(c) whether there is or is likely to be a deposit of a deleterious substance by reason of such work or undertaking that constitutes or would constitute an offence under section 33 and what measures, if any, would prevent such a deposit or mitigate the effects thereof; or

(d) whether the work or undertaking results or is likely to result in any alteration, disruption or destruction of fish habitat that constitutes or would constitute an offence under section 31 and what measures, if any, would prevent such a result or mitigate the effects thereof.

(2) If, after reviewing any material or information provided under sub-section (1) and affording the persons who provided it a reasonable opportunity to make representation the Minister or a person designated by the Minister is of the opinion that an offence under section 31 or 33 is being or is likely to be committed, the Minister or a person designated by the Minister may, by order subject to regulations made pursuant to paragraph (3) (b), or, if there are no such regulations in force, with the approval of the Governor in Council,

(a) require such modifications or additions to the work or undertaking or such modifications to any plans, specifications, procedures or schedules relating thereto as the Minister or a person designated by the Minister considers necessary in the circumstances, or

(b) restrict the operation of the work or undertaking, and with the approval of the Governor in Council in any case, direct the closing of the work or undertaking for such period as the Minister or a person designated by the Minister considers necessary in the circumstances.

(3) The Governor in Council may make regulations

(a) prescribing the manner and circumstances in which any information or material shall be provided to the Minister without request under sub-section (1), and

(b) prescribing the manner and circumstances in which the Minister or a person designated by the Minister may make order under sub-section (2), and the terms of such orders

(4) Where the Minister or a person designated by the Minister proposes to make an order pursuant to sub-section (2), he shall offer to consult with

(a) the governments of any provinces that he considers to be interested in any such proposed order, and

(b) any departments or agencies of the Government of Canada that he considers appropriate, but nothing in this sub-section prevents the Minister or a person designated by the Minister from making an interim order pursuant to sub-section (2) without such consultation where he considers that immediate action is necessary.

3.32

(1) For the purposes of this section, the Minister may designate as an inspector or analyst any person who, in the opinion of the Minister, is qualified to be so designated.

(2) An inspector shall be furnished with a certificate of his designation as an inspector and on entering any place, premises, vehicle or vessel referred to in sub-section (3) shall, if so required, produce the certificate to the person in charge thereof.

(3) An inspector may, at any reasonable time, enter any place, premises, vehicle or vessel, other than a private dwelling place or any part of any place, premises, vehicle or vessel used as a permanent or temporary private dwelling place, where he believes on reasonable and probable grounds that

(a) an offence under section 33 is being, has been or is likely to be committed, or

(b) any work or undertaking described in paragraph 33.1 (1)(a) is being, has been or is likely to be carried on, he may, where he reasonably believes it is necessary to do so for any purpose related to the enforcement of this section, conduct inspections, including examining any substance or product found therein, taking samples thereof and conducting tests and measurements.

(4) Where, out of the normal course of events, there occurs a deposit of a deleterious substance in water frequented by

fish or a serious and imminent danger thereof by reason of any condition, and where any damage or danger to fish habitat or fish or the use by man of fish results or may reasonably be expected to result therefrom, any person who at any material time

(a) owns the deleterious substance or has the charge, management or control thereof, or

(b) causes or contributes to the causation of the deposit or danger thereof, shall, in accordance with any regulations applicable thereto, report such occurrence to an inspector or such other person or authority as is prescribed by the regulations

(5) Every person referred to in paragraph (4) (a) or (b) shall, as soon as possible in the circumstances, take all reasonable measures consistent with safety and with the conservation of fish and fish habitat to prevent any occurrence referred to in sub-section (4) or to counteract mitigate or remedy any adverse effects that result or may reasonably be expected to result therefrom

(6) Where an inspector, whether or not a report has been made under sub-section (4), is satisfied on reasonable grounds that there is an occurrence referred to in sub-section (4) and that immediate action is necessary in order to carry out any reasonable measures referred to in sub-section (5), he may, subject to sub-section (7) and the regulations, take any such measures or direct that they be taken by any person referred to in paragraph (4) (a) or (b).

(7) Any requirement or direction of an inspector under this section that is inconsistent with a requirement or order of a pollution prevention officer under the Canada Shipping Act is void to the extent of the inconsistency

(8) For the purposes of sub-sections (4) to (6), any inspector or other person may enter and have access through any place, premises, vehicle or vessel and may take all reasonable action in order to comply with those sub-sections or any of them, but nothing in this sub-section relieves any person from liability at law for his illegal or negligent acts or omissions or for loss or damage caused to others by such entry, access or action

(9) The Governor in Council may make regulations prescribing

(a) the person or authority to whom or which a report is to be made under sub-section (4), the manner in which the report is to be made, the information to be contained therein and the circumstances in which no report is required to be made;

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SECTION 141

PROTECTION OF WATER COURSES AND WATER BODIES

The use of machinery in a water course or water body shall be avoided where possible. Should it be necessary for equipment to ford a stream, then only a cross over place approved by the Engineer may be used. The same crossing point shall be used each time.

The Contractor shall ensure that cement or fresh concrete does not enter any watercourse or water body and that containers or trucks carrying cement or fresh concrete are not washed out in or on the banks of a watercourse or water body but at a site approved by the Engineer.

Contractors should take note of Section 24 of "An Act Respecting the Department of Environment" which states:

> "subject to the regulations, no municipal authority or person shall discharge or deposit any material of any kind into a body of water or on any shore or bank thereof or in any place that may cause pollution or impair the quality of water for any beneficial use"

Contractors shall carry out all work in such a way so as not to contravene the Environmental Control (Water and Sewage) Regulations, 1980. The principal points of these regulations, as they relate to effluent normally associated with construction work, are as follows:

1. These regulations may be cited as The Environmental Control (Water and Sewage) Regulations, 1980.

2. In these regulations,

a) "Act" means The Department of Consumer Affairs & Environment Act, 1973.

b) "Composite sample" means a quantity of undiluted effluent collected continually at an equal rate or at a rate proportionate to flow over a designated sampling period, and

c) "Grab sample" means a quantity of undiluted effluent collected at any given time.

3. Every person discharging sewage and other materials into a body of water or a public sewer or sewer leading to a public sewer shall comply with the standards, conditions and provisions prescribed in these regulations for the constituents, contents or description of the sewage or other materials so discharged.

4. Subject to section 7, no person shall discharge sewage or other effluent into a public sewer or a sewer leading to a public sewer containing materials which would obstruct or impede the flow of sewage within the public sewer or impair or interfere with the public sewer or any sewage works pertaining thereto, which materials include without prejudice to the generality of the foregoing oil or by-products of oil, flammable, explosive, toxic, poisonous or corrosive liquids, solids or gases, fats, congealing materials and other substances in quantity which interfere with the free flow within the public sewer.

5. Subject to sections 7 and 9, no person shall discharge into a public sewer or sewer leading to a public sewer, sewage or effluent

a) containing a constituent specified in Column 1 of Schedule B having a content in milligrams per litre (parts per million) in excess of the maximum specified in Column 2 of that Schedule.

b) having a temperature in excess of 65°C, or

c) having a pH value less than 5.5 or greater than 9.0

6. Subject to sections 7 and 9, no person shall discharge into a body of water any sewage or effluent

a) containing a constituent specified in Column 1 of Schedule A having a content in milligrams per litre in excess of the maximum specified in Column 2 of that Schedule

b) having a temperature in excess of 32°C

c) having a pH value less than 5.5 or greater than 9.0, or,

d) any radio-active substance having a gross beta activity before discharge of more than 37 Bq per litre with the exception of

(i) radium 226 which shall not in any event exceed 0.37 Bq per litre, and

(ii) strontium 90 which shall not in any event exceed 0.37 Bq per litre

7. Nothing in these regulations shall be construed to permit the discharge of a pollutant into a body of water.

8. All analytical work in relation to effluent samples and receiving water samples is to be carried out using analytical procedures acceptable to the Assistant Deputy Minister of Environmental Management and Control Division of the Department of Consumer Affairs and Environment of the Government of Newfoundland.

9 (1) A person taking effluent samples or receiving water samples shall take them as composite samples or as grab samples.

(2) In the case of composite sampling, all levels are required to be within the appropriate values as established in section 5 and 6 and Schedules A and B.

(3) In the case of grab sampling, 90% of all levels taken in one month shall be within the appropriate values as established in sections 5 and 6 and Schedules A and B.

10. The Minister may, for specific purposes and time periods, as he may by order prescribe, require that a water user or discharger of sewage monitor its effluent for any or all of the constituents in sections 4 and 5 and Schedules A and B report the effluent quality.

11. The Environmental Control (Water and Sewage) Regulations, 1974, are hereby revoked.

SCHEDULE A

Column 1 CONSTITUENTS	Column 2 MAXIMUM CONTENT (In milligrams per litre unless noted)
B.O.D.	20
Coliform - faecal	1000/100 ml
Coliform - total	5000/100 ml
Solids (dissolved)	1000 (see note)
Solids (suspended)	30 (see note)
Oils (Ether extract)	15
Floating debris, oils and grease	none to be visible
Chlorine	1

SCHEDULE B

Column 1 CONSTITUENTS	Column 2 MAXIMUM CONTENT (in milligrams per litre)
5-day B.O.D.	300
Chlorine Demand	30
Fats, Oils & Grease (Ether extract)	100
Suspended Solids	350

NOTES:

(1) If water is being abstracted from a water course, used, treated and subsequently returned to the same water course, these solids data mean that the effluent should not contain more than 1000 or 30 milligrams per litre more than was in the water originally abstracted.

(2) 1 bequerel (bq) - 27.03 pico-curies. Bequerel is the SI unit for the measure of radioactivity.

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Section 142
Navigable Waters Protection Act

All regulations of the Navigable Waters Protection Act shall be strictly adhered to.

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SECTION 180

UNWATERING

The term "Unwatering" shall mean the removal or keeping out of water from the site, in order that work may be carried out in accordance with the specifications.

In an unwatering operation silt laden water containing more than 30 milligrams of suspended solids per litre shall not be disposed of directly into a watercourse or water body, and also silt laden water containing more than 350 milligrams of suspended solids per litre shall not be disposed of directly into a sewer. Silt laden water exeeding these limits shall be discharged to a vegetated area or to a sedimentation basin for removal of silt to within the appropriate limits before being disposed of into a water course or water body, or into a sewer. Where possible the vegetated area shall be not less than 60 m from a water course or water body, unless otherwise directed by the Engineer.

Cofferdams when used shall be constructed with suitable materials so as to render the cofferdam non-erodable and non-poluting. Earthfill cofferdams shall be faced with plastic sheeting followed by sand bags, or equivalent if approved by the Engineer.

180.01 UNWATERING FOR BRIDGE FOUNDATIONS

Unwatering for Bridge Foundations may be a contract pay item and is dealt with as part of Section 902.

180.02 PAY ITEM UNWATERING FOR A CULVERT

Where Unwatering for a Culvert is an item appearing on the Unit Price Table, then payment at the lump sum contract price for unwatering the culvert shall be payment in full for all labour, materials and equipment-use to provide such temporary water-tight structures and pumps as are required to unwater the culvert, and then after completion of the work to remove the unwatering facilities and clean up and trim the site to sightly proportions.

180.03 UNWATERING INCIDENTAL TO THE WORK ON HAND

Where unwatering is not a pay item, but is required in order to carry out other work, then such necessary unwatering shall be provided by the Contractor. The Contractor shall provide such temporary water-tight structures and pumps as are required for unwatering, and then after completion of the work, remove the unwatering facilities and clean-up and trim the site to sightly proportions, all at his own expense.

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SECTION 902

EXCAVATION FOR FOUNDATION, UNWATERING AND EXTRA BACKFILL FOR STRUCTURES

INDEX

902.01 DESCRIPTION OF EXCAVATION

902.02 CLASSIFICATION

902.03 PROTECTION

902.04 UNWATERING FOR BRIDGE FOUNDATIONS

902.05 EXTRA BACKFILL

- 902.05.01 Select Backfill
- 902.05.02 Compacted Ordinary Fill

902.06 UNASSIGNED

902.07 UNASSIGNED

902.08 MEASUREMENT FOR PAYMENT

902.09 BASIS OF PAYMENT

- 902.09.01 Excavation For Foundations
- 902.09.02 Unwatering
- 902.09.03 Extra Backfill Select Material
- 902.09.04 Extra Backfill Compacted Ordinary Fill
- 902.09.05 Overexcavation

902.01 DESCRIPTION OF EXCAVATION

Excavation shall include the removal of all material necessary for the construction of foundations and substructures in accordance with the plans or as directed by the Engineer.

All rock or other hard foundations shall have all loose or soft material removed to present a clean firm surface.

When a footing is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation. In soft conditions the final removal of material to foundation level shall not be made until the Contractor is ready to proceed with the construction of the footing.

Footing elevation shall be considered as approximate only and may be ordered to be changed by the Engineer on evaluation of conditions as the excavation proceeds.

Overexcavation shall be replaced by suitable compacted material to be approved by the Engineer.

Unless otherwise specified no excavation shall be made outside of that required for constructing substructure and the natural streambed adjacent to the structure shall not be disturbed without permission from the Engineer. The Contractor shall ensure that the channel is brought back to its original condition unless otherwise authorized.

After each excavation is completed, the Contractor shall notify the Engineer and no concrete or other backfill shall be placed until the depths of excavation and the nature of the foundation material has been affirmed as satisfactory.

902.02 CLASSIFICATION

Excavation shall be measured and classified as solid rock and other material. Provided that whenever the classes of material excavated cannot be accurately measured separately, the material will be classified on a percentage basis.

a) Solid Rock — shall include all rock in masses or ledges in their original or stratified bed or position and all boulders and detached pieces or rock exceeding 0.50 m^3.

b) Other Material — shall include all solid material other than solid rock as defined above including boulders less than 0.50 m^3

902.03 PROTECTION

All substructure work shall be adequately shored, braced or otherwise adequately protected in a rigid fashion in accordance with Section 907, Formwork and Falsework.

Where the stability, safety or function of an existing roadway, railway or other works can be impaired by an excavation or temporary slope, the Contractor shall provide such protection as may be required including sheeting, shoring and driving of piles where necessary to prevent damage to such works.

Unless otherwise specified, any materials used for protection shall remain the property of the Contractor and shall be removed from the jobsite when no longer required.

902.04 UNWATERING FOR BRIDGE FOUNDATIONS

The Contractor shall carry out all work necessary to prevent disturbance to the foundation and unless otherwise specified, he shall place all the concrete in the dry.

Where the term ''unwatering'' is used in this specification it shall mean the removal of all water that would impede the placing of concrete for the foundations of the permanent structures by means of temporary water-tight structures and pumps.

The Contractor shall submit plans and descriptions outlining the methods of unwatering that he intends to use. These plans shall be approved by the Engineer before construction is started, approval will not relieve the Contractor of his responsibility for unwatering the foundations to the satisfaction of the Engineer. Any damage to the permanent structure due to any failure of the temporary structure used in the unwatering operations shall be remedied at the expense of the Contractor to the satisfaction of the Engineer, even to the extent of removal and reconstruction of said permanent structure.

Unwatering for bridge foundations shall include the supply of all equipment, materials and labour for the construction of the necessary water-tight temporary structures, their pumping out and subsequent removal and shall be paid for at the lump sum bid in the tender.

Earthfill cofferdams shall be faced with a layer of plastic sheeting followed by sand bags. The purpose is to produce a dam that permits the least amount of infiltration and therefore requires the minimum amount of unwatering

No effluent from an unwatering operation shall be disposed of directly into a watercourse or water body. Effluent shall be discharged to a vegetated area or to a sedimentation basin for silt removal before being returned to a watercourse. Where possible the vegetated area shall be not less than 60 m from a water course or water body unless otherwise directed by the engineer.

If for any reason all water cannot be removed from the forms so as to permit concrete to be placed in the dry, the Engineer may authorize, upon receipt of a written request from the Contractor, the placing of a concrete seal by means of a tremie pipe or some other method. When a concrete seal is so authorized the Contractor shall supply at his own expense all equipment, materials and labour necessary for such tremie concrete and no payment will be made for tremie concrete so placed other than under the lump sum bid for "Unwatering".

Unless otherwise specified, all temporary unwatering and support structures shall remain the property of the Contractor and shall be removed from the jobsite when no longer required

902.05 EXTRA BACKFILL

902.05.01 Select Material Compacted

The quality of this material shall be granular, complying with the Department of Transportation specification for Class "C" selected Granular Base Course Material. It may be pit-run or crushed and the percentage of material passing the 75 um sieve shall not exceed 6%, so that free draining conditions are ensured. French drains shall be placed at weep holes.

The select material compacted shall be placed in shallow lifts not to exceed 600 mm in depth. The backfill can be spread with a bulldozer and after each layer is spread, a vibratory compactor must be used as directed by the Engineer

The compactor shall compact the backfill to a minimum of 95% of the maximum Standard Proctor Density (ASTM D698-78). When directed by the Engineer, water may be added to assist the compaction but the amount of water added should not bring the moisture content above the optimum for the compactive effort used.

The location of a source of sufficient suitable material is solely the responsibility of the Contractor.

No backfill shall be placed against an abutment, wingwall or retaining wall until permission has been obtained from the Engineer

Filling around arches, rigid frames and piers shall proceed simultaneously and evenly on both sides so as to avoid differential surface elevation in excess of 500 mm

902.05.02 Compacted Ordinary Fill

All material and placing shall be in accordance with Section 204. However, location of the source will be the responsibility of the Contractor

902.08 MEASUREMENT FOR PAYMENT

Excavation shall be measured in cubic metres in original position of material acceptably excavated in conformity with the plans or as directed by the Engineer but no volume shall be included in the measurement for payment which is outside the volume bounded by vertical planes parallel to and above neat lines of the footings. The volume measured shall not include water or other liquids but shall include mud. The top and bottom limits of payment volume shall be the original ground surface and the bottom of the completed footing.

The volume of boulders in excavation shall be determined on the basis of the three maximum rectilinear dimensions.

Select backfill shall be paid by cubic metres in place and the volume measured shall be that between the theoretical grades and lines as shown on the drawings.

902.09 BASIS OF PAYMENT

902.09.01 Excavation For Foundations

Payment at the contract price for "Excavation For Foundations" (a) Solid Rock and (b) Other Material, shall be full compensation for all labour, equipment and material for all excavation required, protection of the excavation, protection of adjacent works, unwatering, backfilling and compacting around the footing and disposal of any surplus or unsuitable excavated material

902.09.02 Unwatering

Payment at the contract price for the item "Unwatering" in Structure Unit Price Table shall be full compensation for all labour, equipment and material to do the work according to the specifications

902.09.03 Extra Backfill Select Material

Payment at the contract price for Extra Backfill Select Material Compacted shall be full compensation for all labour, equipment and material involved in the cost of locating, obtaining approval, clearing, grubbing, hauling, loading, placing of granular backfill to the structure, the material at weephole drains, placement of the weep holes in the concrete abutment for compacting the material and all other work required to place and ensure compaction of the material according to the specifications.

902.09.04 Extra Backfill Compacted Ordinary Fill

Payment at the contract price for Extra Backfill Compacted Ordinary Fill shall be full compensation for all labour, equipment and material, locating, obtaining approvals, clearing, grubbing, hauling, loading, placing and compacting the fill and all other work necessary to comply with specifications on Section 204.

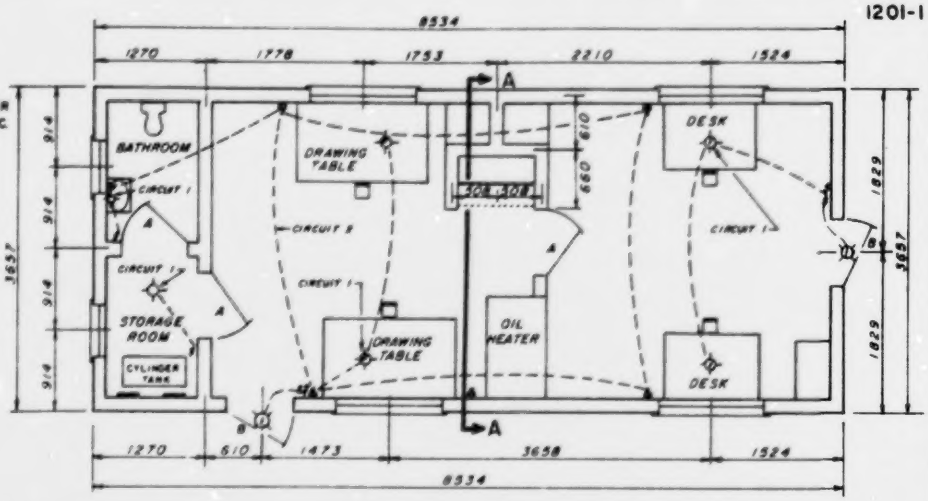
902.09.05 Overexcavation

Payment will not be made for overexcavating due either to the Contractor's method of operation or his negligence.

AMENDED FORM 1201 FEBRUARY 1983
(SUPERSEDING FORM 1201 JANUARY 1982)

1201-1

NOTE - CONC. TEST CYLINDER TANK REQUIRED ON CONC. BRIDGE OR CONCRETE PAVEMENT PROJECTS.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3657
BATHROOM
CIRCUIT 1
CIRCUIT 1
STORAGE ROOM
CYLINDER TANK
A
A
DRAWING TABLE
CIRCUIT 2
CIRCUIT 1
DRAWING TABLE
610
660
OIL HEATER
A
DESK
CIRCUIT 1
DESK
1829
1829
3657
B
B
A
1270
610
1473
3658
1524
8534

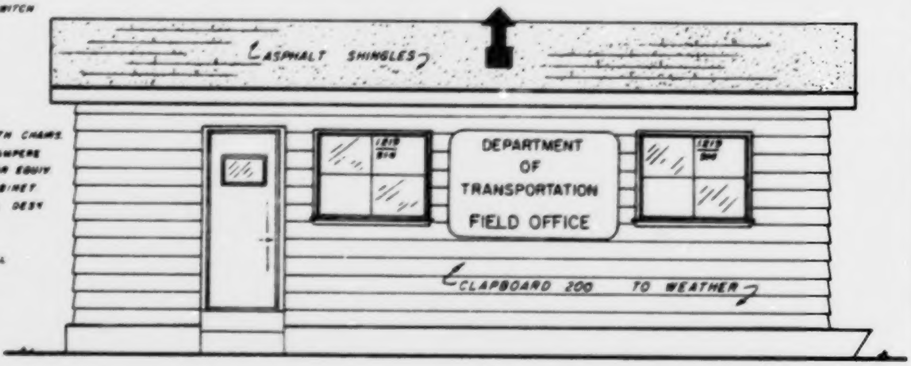
FLOOR PLAN

SYMBOLS

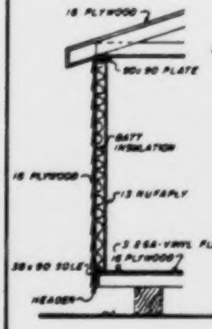
-Ⓕ-	FLUORESCENT 40W 2 TUBE LIGHT.
-Ⓘ-	INCANDESCENT LIGHT
⦶	DUPLEX OUTLET
$	TOGGLE SWITCH
▬	60A DISCONNECT SWITCH
▭	4 CIRCUIT DIST. BOX
A	3-762 x 1982 DOORS
B	2-812 x 2032 DOORS

FURNITURE REQUIREMENTS

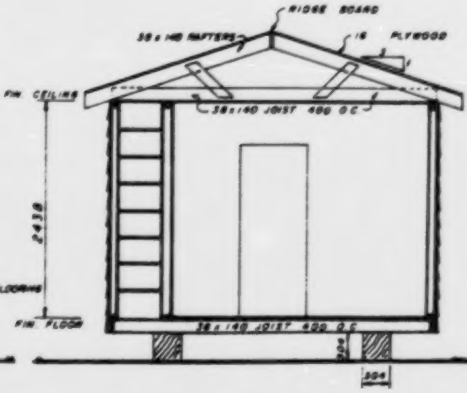
1. 2-1524 x 914 DRAWING TABLES WITH CHAIRS.
2. 2 DRAFTING LAMPS DAZOR 0.55 AMPERE 118 VOLTS 55 WATTS, 60 CYCLE OR EQUIV.
3. 1-4 DRAWER STEEL FILING CABINET.
4. 2-1066 x 762 SINGLE PEDESTAL DESK WITH UNIVERSAL LOCKING
5. 2-CHAIRS FOR ABOVE DESK.
6. 1-40 000 MINIMUM KILOJOULE OIL SPACE HEATER


ASPHALT SHINGLES
1219
914
DEPARTMENT
OF
TRANSPORTATION
FIELD OFFICE
1219
914
CLAPBOARD 200 TO WEATHER

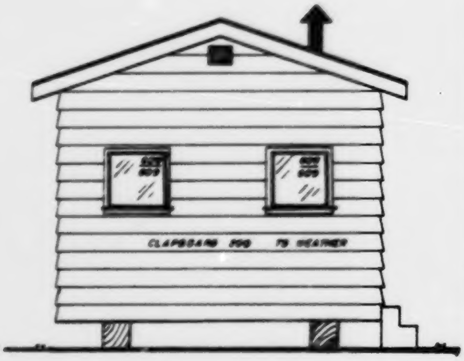
FRONT ELEVATION


16 PLYWOOD
90 x 90 PLATE
BATT INSULATION
16 PLYWOOD
13 RUFAPLY
3 GGA-VINYL FLOORING
16 PLYWOOD
38 x 90 SOLE
HEADER

TYPICAL WALL SECTION


RIDGE BOARD
38 x 140 RAFTERS
16 PLYWOOD
FIN. CEILING
38 x 140 JOIST 400 O.C.
2438
FIN. FLOOR
38 x 140 JOIST 400 O.C.
200
304

SECTION A-A


CLAPBOARD 200 TO WEATHER

LEFT ELEVATION

(NOTE) ALL DIMENSIONS SHOWN IN MILLIMETRES

DEPARTMENT OF TRANSPORTATION

FIELD OFFICE

DRAWN BY M.D.A. DATE

Department of
Transportation
NEWFOUNDLAND

SECTION 201

CLEARING AND GRUBBING

INDEX

201-1 DESCRIPTION
201.02 PERMITS AND AUTHORIZATION
201.03 CLEARING AND GRUBBING OPERATIONS
201.04 MEASUREMENT FOR PAYMENT
201.05 BASIS OF PAYMENT

201.01 DESCRIPTION

Clearing and grubbing shall consist of the removal and disposal of all trees, brush, logs, surface boulders, stumps, roots, matted roots and other vegetation from within areas selected by the Engineer.

202.02 PERMITS AND AUTHORIZATION

The Contractor is required to obtain a permit to cut trees. Application for a permit should be made to the local office of the Department of Forest Resources and Lands.

Should the contractor wish to burn brush, then prior permission must first be obtained from the Department of Forest Resources and Lands.

201.03 [redacted]

[redacted]

[redacted]

The Department, should it so wish, may permit the Contractor to dispose of any timber cut on Crown Land to his advantage providing the requirements of the Crown Lands Act, with respect to royalties, etc., are met.

Where timber to be cleared and grubbed is on land belonging or leased to private individuals, crown corporations or companies, the timber does not become the property of the Contractor. The Contractor must make prior arrangements with land owners or leases for the disposal of the timber.

[redacted] [redacted] shall assume all liability for claims which may arise from any such damage.

Surface boulders, regardless of their size, shall be considered as part of clearing and grubbing. All surface boulders shall be removed and disposed of along with the other clearing and grubbing debris.

[redacted]

[redacted]

Where clearing and grubbing takes place in preparation for a borrow area outside of the right of way then clearing and grubbing debris may be pushed upon adjacent land provided that in so doing the debris is not pushed onto land belonging to others.

[redacted]

201.04 MEASUREMENT FOR PAYMENT

Measurements will be made of the horizontal area actually cleared and grubbed from within the area staked out by the Engineer. These measurements shall be computed to obtain the area in hectares, measured to three decimal places.

Clearing and grubbing beyond the limits staked will not be measured for payment.

201.05 BASIS OF PAYMENT

Payment at the contract price for Clearing and Grubbing shall be compensation in full for all labour, materials and equipment-use to carry out the work indicated in this specification or in any way connected with these operations.

No payment, other than that provided for in the contract price for Clearing and Grubbing, will be made for top-soils and surface boulders removed by clearing and grubbing operations, or for any and all haulage involved in clearing and grubbing debris disposal.

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SECTION 202

CLEARING

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201.01 DESCRIPTION
202.02 PERMITS AND AUTHORIZATION
202.03 CLEARING OPERATIONS
202.04 MEASUREMENT FOR PAYMENT
202.05 BASIS OF PAYMENT

202.01 DESCRIPTION

Clearing shall consist of the cutting of trees and brush and the removal, piling and burning or other disposal of all trees, brush and logs from within areas designated by the Engineer. However, clearing will not normally be performed within areas selected as borrow pits and quarries.

202.02 PERMITS AND AUTHORIZATION

[redacted]

[redacted]

202.03 CLEARING OPERATIONS

[redacted]

[redacted] commence until the Contractor has [redacted]

If so ordered by the Engineer, certain trees within the right of way shall be preserved. Underbrush, down timber, snags and roots shall be removed from the vicinity of such preserved trees to a cleared space within the right of way and then burned.

[redacted]

[redacted]

No timber, brush or logs shall in any event be piled upon adjacent lands unless authority is first obtained from the Engineer.

The limits of the right of way shall be left in proper shape for fencing.

[redacted]

The Contractor shall be permitted to use for construction purposes under this Contract any timber cut on the right of way provided that the sizes and quality of such timber meets the requirements of the plans and specifications and is acceptable to the Engineer.

[redacted]

[redacted]

The Contractor [redacted] liability for claims which may arise from any such damage.

202.04 MEASUREMENT FOR PAYMENT

Measurement will be made of the horizontal area actually cleared from within the area staked out by the Engineer. These measurements shall be computed to obtain the area in hectares, measured to three decimal places.

Clearing beyond the limits staked will not be measured for payment.

202.05 BASIS OF PAYMENT

Payment at the contract price for clearing shall be compensation in full for all labour, materials and equipment-use to carry out the work indicated in this specification and shall include all costs involved in obtaining and conforming to the conditions of required permits, together with either burning the debris, or obtaining an approved waste disposal area and hauling away and disposing of the debris in the waste disposal area.

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SECTION 207

[redacted]

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207.01 SCOPE
207.02 DESCRIPTION
207.03 CLASSIFICATION
207.04 MEASUREMENT FOR PAYMENT
207.05 BASIS OF PAYMENT

207.01 SCOPE

This specification concerns borrow where the source of the borrow is supplied by the Department.

However, where the Contractor is required to supply the source of material, as in Contract items such as; "Supply Rock Fill in Place" or "Supply Other Material Fill in Place", then the requirements are covered separately in Section 316 "Use of Pits and Quarries and Stockpiles for Production of Materials Supplied by Contractor".

207.02 DESCRIPTION

[redacted]

This work shall include all materials and labour required to excavate borrow materials, hauling up to 1 km, the handling and the incorporation of the materials into fill construction in accordance with Section 204 "Grading of Fill".

[redacted]

[redacted]

In all cases where borrow pits or quarries are located outside the limits of the right of way they will be provided and paid for by the Department.

[redacted]

The Contractor shall be responsible for all damages to utility lines or adjoining property caused by blasting or from any cause whatsoever resulting from any of his operations in connection with his work.

[redacted]

[redacted]

[redacted]

[redacted]

207.03 CLASSIFICATION

Borrow materials will be classified as either "Solid Rock", "Quarried Rock", "Other Material", or "Other Material Borrow" in accordance with Section 205, "Classification of Excavated Materials.

207.04 MEASUREMENT FOR PAYMENT

Measurement for payment will only include measurement of quantities that are required by the Engineer.

Payment by Volume

For borrow materials described in 207.03 Classification, that are to be paid for in terms of the number of cubic metres of borrow material, then such materials shall be measured for payment in accordance with Section 205.05 Measurement for Payment.

Payment by Weight

For borrow materials, described in 207.03 Classification, that are to be paid for in terms of the number of tonnes, then such materials shall be weighed on scales. The scales shall be provided by the Contractor and they shall conform with the requirements of Section 501 "Weighing of Materials in Trucks". The Department will supply scale tickets, and the Department Scale Checker will issue the tickets. Only loads certified by the Department Road Checker as being placed in the works shall be included in measurement for payment. The weight shall be computed in tonnes, rounded to one decimal place.

207.05 BASIS OF PAYMENT

Where the Contract includes quantities for "Quarried Rock", then all required excavation of solid rock from borrow areas will be paid for at the Contract price for "Quarried Rock".

However, should the Contract not include quantities for quarried rock, then all required excavation of solid rock from borrow areas will be paid for at the contract price for "Excavation Hauled 1 km or Under, Solid Rock".

Where the Contract includes quantities for "Other Material Borrow", then all required excavation of other material from borrow areas will be paid for at the Contract price for "Other Material Borrow."

However, should the Contract not include quantities for other material borrow, then all required excavation of other material from borrow areas will be paid for at the Contract price for ''Excavation Hauled 1 km or Under, Other Material''.

Payment shall be at the Contract Unit Price per cubic metre, or per tonne, for either ''Solid Rock'', ''Quarried Rock'', ''Other Material'' or ''Other Material Borrow'', as the case may be, hauled 1 km or under. Such payment shall be full compensation for all work herein described together with all materials and labour required to carry out excavating, handling, provision for weighing (if appropriate), hauling up to 1 km and placing and compacting in a fill as described in Section 204 ''Grading of Fill''.

However, Clearing and Grubbing shall be paid for separately in accordance with Section 201 ''Clearing and Grubbing''.

Where the Engineer requires that borrow material be hauled in excess of 1 km, additional payment for overhaul will be made in accordance with Section 215 ''Overhaul on Excavated Materials''.

AMENDED FORM 212 FEBRUARY 1983
(SUPERSEDING FORM 212 JANUARY 1982)

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SECTION 212

EXCAVATION OF MUSKEG OR BOG

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212.01 DESCRIPTION
212.02 MEASUREMENT FOR PAYMENT
212.03 BASIS OF PAYMENT

212.01 DESCRIPTION

This work shall include labour and materials to excavate muskeg or bog from within areas staked on the ground by the Engineer, together with the spreading and trimming of the excavated material.

Whether or not, and to what width bog is to be excavated will normally be determined in accordance with the spirit of the guide lines in Section 1209.

The Contractor shall ensure that all bog, together with the accompanying pug, if any, is removed from within the designated areas.

[redacted]

[redacted]

212.02 MEASUREMENT FOR PAYMENT

Volumes of excavation of muskeg or bog will be measured in excavation and computed in cubic metres rounded to the nearest whole number.

Measurements shall be by means of cross-sections, or where wet conditions make the obtaining of after sections impractical, by means of a combination of original sections and bog soundings.

The quantity to be measured shall be the number of cubic metres of excavated material as shown between the position of the ground lines as cross-sectioned beforehand, and the completed and accepted excavation lines measured either by cross-sections or bog soundings. Material excavated outside of the required limits will not be included in measurement for payment. No measurement for payment will be made for the removal of materials that slide or slough into the excavation, nor shall separate payment be made for the removal of such material.

The volume of the excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be when terminating at grade points.

No allowance will be made for material excavated before cross-sections have been made.

212.03 BASIS OF PAYMENT

Where the Contract includes quantities for "Muskeg or Bog", then all required excavation of muskeg or bog will be paid for at the Contract price for "Muskeg or Bog".

However, should the Contract not include quantities for muskeg or bog, then all required excavation of muskeg or bog will be paid for at the Contract Price for "Excavation Hauled 1 km or Under, Other Material."

Payment shall be at the Contract Unit Price per cubic metre for "Muskeg or Bog" or "Other Material", as the case may be, hauled 1 km or under. Such payment shall be full compensation for labour and materials to carry out the operations herein described.

However, where the Engineer requires that excavated muskeg or bog be hauled in excess of the 1 km freehaul before being placed, additional payment for overhaul will be made in accordance with Section 215 "Overhaul on Excavated Material", at the appropriate rate for overhaul on excavation Other Material.

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SECTION 305

[redacted] CALCIUM CHLORIDE

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305.02 MATERIALS
305.03 APPLICATION
305.04 MEASUREMENT FOR PAYMENT
305.05 BASIS OF PAYMENT

305.01 SCOPE

This specification covers the requirements for the application of a solution of calcium chloride in water to such areas of gravel roads that the Engineer may designate.

305.02 MATERIALS

The calcium chloride will be supplied in the form of sacks of calcium chloride crystal flakes. The Department will supply the Contractor with sacks of calcium chloride flakes required for the contract at the Department's salt storage facility nearest to the job.

Water for use in making the solution of calcium chloride shall be supplied by the Contractor and shall consist of suitable clean water.

305.03 APPLICATION

The Engineer will designate the limits between which the calcium chloride treatment is to be applied to the road.

The Contractor shall grade up the road to be treated to obtain a smooth grade prior to application of the calcium chloride.

The Contractor shall load the required sacks of calcium chloride at the point of supply and transport them to the job. The loading of the sacks is the responsibility of the Contractor and the loading must be carried out during the Department's regular working hours.

The Contractor shall form a solution of calcium chloride and water of known proportions, so that the rate of application of calcium chloride is known and can be controlled by manipulation of the spreader.

The rate of application of the solution shall be such that the required weight of dissolved flakes is applied to each square metre of road surface. The rate of application shall be 0.9 kilograms of dissolved flakes per square metre, or such other rate of application of calcium chloride as the Engineer may designate.

The calcium chloride shall be applied uniformly by the approved spreader.

The Contractor shall compact the treated gravel surface to 100% of Standard Proctor Density.

Any spill of calcium chloride such as arising from broken bags or otherwise must be immediately cleaned up. Any quantity of calcium chloride that is recovered from a spill and cannot be utilized in the normal manner must be disposed of at an approved waste disposal site at the Contractor's expense. Information on these sites can be obtained from the Provincial Department of Environment.

305.04 MEASUREMENT FOR PAYMENT

Measurement for payment shall be of the number of tonnes, rounded to two decimal places, of the calcium chloride flakes made into solution and applied within the required limits. This measurement will be made by computing the net weights of the sacks used.

305.05 BASIS OF PAYMENT

Payment at the contract price for calcium chloride shall be compensation in full for all labour, materials and equipment-use to: transport the sacks of calcium chloride from the point of supply to the job, supply water and make up a solution, grade up the area to be treated, apply the calcium chloride solution and compact the road surface.

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SECTION 310

USE OF PITS AND QUARRIES AND STOCKPILES FOR PRODUCTION OF MATERIALS SUPPLIED BY CONTRACTOR

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310.06 STRIPPING PITS AND QUARRIES

310.06.01 Additional Requirements for Stripping Pits and Quarries intended for Aggregate, Winter Sand, and Selected Granular Base Course Production

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310.09 AGGREGATES AND SELECTED GRANULAR BASE COURSE SAMPLING AND APPROVAL

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310.13.02 Basis of Payment for Aggregates and Select Granular Base Courses
310.13.03 Basis of Payment for Armour Stone and Rip Rap Stone
310.13.04 Basis of Payment for "Supply Rock Fill in Place" and "Supply Other Material Fill in Place"

310.01 SCOPE

This specification covers the Department's requirements for the use of pits and quarries for the production of materials to be supplied by the Contractor, namely: selected granular base courses, paving aggregates, winter sand, concrete aggregates, chip seal aggregate, armour stone, rip rap stone, select bedding for storm sewers, and such other materials that may be specified to be supplied by the Contractor, together with Rock Fill in Place and Other Material Fill in Place where the contract item states "Supply Rock Fill in Place", or "Supply Other Material Fill in Place". Also included in this specification are the requirements for the stockpiling of; aggregates, winter sand, and selected granular base courses.

However, this specification will not apply, but Section 201

"Clearing and Grubbing" and Section 207 "Borrow" will both apply for the use of pits or quarries for the production of borrow where the required borrow material is specified in the Contract item as; "Excavation Hauled 1 km or Under Solid Rock", "Excavation Hauled 1 km or Under Quarried Rock", "Excavation Hauled 1 km or under Other Material", or "Excavation Hauled 1 km or Under Other Material Borrow."

310.02 PIT AND QUARRY INFORMATION

The Department will make available to the Contractor all information obtained by the Department as to sources of supply. Such information represents only the opinion of the Department as to the location, character or quantity of the material encountered and is available only for the convenience of the Contractor.

The Department assumes no responsibility whatever in respect to the sufficiency or accuracy of the information and there is no guarantee, either expressed or implied, that the conditions indicated are representative of those existing throughout the work or that un-anticipated developments may not occur. It shall be the Contractor's responsibility to locate sources and to furnish and haul the aggregate and/or selected granular base course.

310.03 PIT AND QUARRY SAMPLING

The Department will make its testing facilities available to the Contractor for the purposes of testing the suitability of pits or quarries for the production of the required materials.

Preliminary approval of the quality and nature of the material submitted in samples will not constitute general acceptance of all the material in the source of supply.

310.03.01 Additional Pit and Quarry Sample Requirements for Selected Granular Base Courses, Winter Sand, and all Aggregates

The Contractor shall submit representative samples of all materials proposed for use as selected granular base courses, winter sand, paving aggregates, concrete aggregates, and chip seal aggregates. The Contractor shall deliver the samples to the Department's Laboratory in St. John's for approval of quality and nature prior to use in the work. Each sample shall contain not less than 25 kg of material.

Unless otherwise specified by the Engineer, initial samples for quality testing may be of the materials in their natural state. The Contractor shall at his own expense, sufficiently expose his proposed source of aggregates either by opening at the face, by excavating test pits, or by core drilling so that representative samples of the material can be obtained. Subsequent and progress samples for quality testing shall be of the processed materials.

310.04 [redacted]

310.04.01 [redacted]

The [redacted] ensuring that his pit or quarry operations are carried out in conformity with all land-use or zoning regulations which may apply.

310.04.02 [redacted]

Contractors are advised, that should the Contractor wish to carry out his pit or quarry operations on lands for which the mineral and quarry rights are vested in the crown, then the Department of Mines and Energy requires that prior approval be obtained before pit or quarry operations may begin. It is the responsibility of the Contractor to obtain the quarry permit from the Department of Mines and Energy.

310.04.03 [redacted]

Should the removal of trees be involved in the preparation of a pit or quarry, then the Contractor is required to obtain a permit to cut the trees.

Application for a cutting permit should be made to the local office of the Department of Forest Resources and Lands.

Should the Contractor wish to burn brush, then prior permission must first be obtained from the Department of Forest Resources and Lands.

310.04.04 [redacted]

Contractors wishing to set up an aggregate washing operation at a site must first obtain environmental approval before proceeding.

Contractors must apply in writing to the Department of the Environment for a Ministerial Approval as required in Section 23 of the Department of the Environment Act, 1981. The following information must be supplied with the application:

1) Location of the proposes site.

2) Expected dates of operation of the washing plant:

   - — proposed starting date
   - — total days in operation
   - — hours in operation per day
   - — proposed completion date

3) Rate at which water is to be used (L/s).

4) Number and dimensions of settling ponds and the method of lining of the ponds.

310.05 CONTRACTOR'S NOTICE OF INTENT TO PRODUCE AGGREGATES, WINTER SAND, AND SELECTED GRANULAR BASE COURSES

Proir to the production of; aggregates, winter sand, and selected granular base courses, written notice of intent shall be provided to the Soils and Paving Engineer and to the appropriate District Engineer. Such notice of intent shall contain the scheduled starting date, pit or quarry location and processing equipment to be used. This notice of intent shall be received by the above mentioned Department personnel at least 7 days prior to any production.

310.06 [redacted]

Prior to excavating materials, the area to be worked shall be cleared, grubbed and stripped of all unsuitable surface materials.

The topsoil shall be removed separately from the underlying materials and stockpiled. The Contractor shall ensure that the quality of the topsoil is not reduced by mixing with other materials removed during the grubbing or stripping operations.

A sufficient area shall be opened ahead of the quarrying or pit excavating operation to positively prevent contamination by deleterious materials.

Special attention is drawn to Government Directive not to have pits or quarries visible from the road.

A natural screen of at least 40 m width must be left between the pit or quarry and the highway. Should this not prove possible, then prior approval of the Engineer must be obtained before any part of the 40 m screen may be stripped.

310.06.01 Additional Requirements for Stripping Pits and Quarries Intended for Aggregate, Winter Sand, and Selected Granular Base Course Production

Where the pit or quarry is intended for use in the production of aggregates, winter sand or selected granular base course, then the pit or quarry shall also be stripped of all weathered zones.

310.07 WORKING OF PITS SUITABLE FOR AGGREGATE OR SELECTED GRANULAR BASE COURSE PRODUCTION

The Contractor will not be permitted to work natural sand or gravel deposits in an indiscriminate manner that results in otherwise usable natural gravels being rendered unfir for future use in aggregate, winter sand or selected granular base course production. In such pits the Contractor will be required to use equipment which will excavate a vertical face extending from the floor of the pit to the surface of the deposit. The undermining of high faces will not be permitted. The use of scrapers, bulldozers, draglines and other types of equipment, which remove the deposit in more or less horizontal layers is prohibited, except for unique circumstances where it is demonstrated to the satisfaction of the Engineer that an acceptable and consistent product can be obtained by this method.

310.08 PHYSICAL AND OTHER REQUIREMENTS

310.08.01 Physical and Other Requirements for Aggregates, Winter Sand and Selected Granular Base Courses

Paving aggregates, concrete aggregates, chip seal aggregate, winter sand and selected granular base courses shall conform to the appropriate physical and gradation requirements for that required type of material, as expounded in; Section 330 ''Hot Mix Asphaltic Concrete'', Section 904 ''Concrete Structures'', Section 340 ''Chip Seal'', Section 317 ''Winter Sand'', and Section 315 ''Selected Granular Base Course'', respectively.

Chip seal aggregate shall be screened and washed over a 6.35 mm screen. If the chip seal aggregate is to be stockpiled, then screening and washing shall be performed before stockpiling.

310.08.02 Physical and Other Requirements for Armour Stone and Rip Rap Stone

Armour Stone and Rip Rap Stone shall conform to the requirements given in Section 615 ''Armour Stone'' and Section 619 ''Rip-Rap Treatment'', respectively.

310.08.03 Physical and Other Requirements for Material to be used as ''Rock Fill in Place''

Material to be used as rock fill in place, shall only consist of quarry material which before it was excavated consisted entirely of solid rock as defined in Section 205 ''Classification of Excavated Materials''.

The rock fill shall be thoroughly fragmented and well graded with fragments of greatest dimension not more than 500 mm. The rock fragments shall consist of hard durable material.

The rock fill material shall not contain frozen lumps, weeds, sods, roots, logs, stumps or any other objectional matter.

Material that is proposed be used as rock fill material shall be subject to test by the Engineer to determine its suitability for the portions of the work in which it is proposed that it be placed. Only rock fill material approved by the Engineer shall be placed in the work.

310.08.04 Physical and Other Requirements for Material to be used as ''Other Material Fill in Place''.

Material to be used as ''Other Material Fill in Place'' shall consist of only well graded other material which is approved for use by the Engineer.

Other material containing stones larger than 150 mm will not be acceptable for use as ''Other Material in Place'' unless the Contractor places the larger stones in accordance with the requirements of Section 204 ''Grading of Fill''.

For the top 300 mm of fill immediately below sub-grade, the material for use as ''Other Material in Place'' shall have no more than 12% passing the 75 μm. sieve, unless otherwise specified.

The other material shall not contain frozen lumps, weeds, sods, roots, logs, stumps or any other objectional matter.

Material that is proposed to be used as other material fill shall be subject to test by the Engineer to determine its suitability for the portions of the work in which it is proposed that it be placed. Only O.M. Fill material approved by the Engineer shall be placed in the work.

310.09 AGGREGATES AND SELECTED GRANULAR BASE COURSES SAMPLING AND APPROVAL

A field laboratory conforming to the requirements of Section 111 ''Field Laboratory'' shall be set up on the site of the project and be ready for use, before any crushing of material may take place. The laboratory shall also be set up and be ready for use before any placing of selected granular base course class C may take place.

All aggregates and selected granular base courses shall be subject to sampling and testing by the Engineer at all times, and the Engineer shall be provided ample opportunity to sample any material at any time. Any material of a quality or nature not suitable for its intended use will be rejected.

Only materials approved by the Engineer shall be incorporated in the work.

310.09.01 Selected Granular Base Course and Chip Seal Aggregate Sampling and Approval

Where selected granular base course or chip seal aggregate are taken from the crusher and placed in stockpiles, acceptance or rejection shall be decided on the basis of test results of samples taken from the stockpile as it is being constructed.

310.09.02 Paving Aggregates Sampling and Approval

The Department will undertake preliminary testing at any time to assist the Contractor in locating and producing suitable aggregates. The tests will be carried out solely for the benefit and guidance of the Contractor and will not necessarily constitute acceptance of the aggregate.

The Contractor shall take great care in the crushing of aggregates to ensure the production of consistent and uniform material.

310.10 STOCKPILING OF AGGREGATES, WINTER SAND AND SELECTED GRANULAR BASE COURSES

Paving aggregate, chip seal aggregate, concrete aggregate, winter sand, and selected granular base course aggregate shall be handled, transported and stockpiled at all times in such a manner and with such equipment that will avoid segregation and/or contamination by any deleterious material. The contractor will provide and ensure legal access for the Department or its agents to this stockpile area.

Materials shall be stockpiled on a flat, well draining area of sufficient size to accept the entire quantity to be produced. The area shall be free from all foreign material and be of adequate bearing capacity.

Materials shall be stockpiled in layers not exceeding 1 m in depth. Each layer shall be completed over the entire area of the stockpile before beginning the next layer. The back layer of the stockpile shall be spread by a dozer, with a blade of suitable design. In such a manner that the materials are thoroughly mixed to a uniform consistancy. Special attention should be given, that each one metre layer is interlocking to the adjoining one. Materials delivered to the stockpile in trucks shall be uniformly spot-dumped and leveled, complying to the method as specified above.

Coning stockpiles or spilling material over the edges of the stockpiles will not be permitted under any circumstances.

It is the express responsibility of the Contractor to ensure that stockpiles, when constructed, contain material of acceptable quality, uniformly distributed throughout. Aggregates which have become mixed with foreign matter of any description, segregated by any means, or have become mixed with each other, shall not be used and shall be removed from the stockpile immediately.

Aggregates separated during processing, aggregates secured from different sources, and aggregates from the same source but of different gradations, shall be placed in individual stockpiles.

Individual stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

Where stockpiles are constructed for use by others, the storage area shall be situated on solid ground with a suitable access road provided. Storage and access area must withstand working with heavy equipment and trucks. Such storage area and access road shall be subject to the approval of the Engineer.

310.11 [redacted]

All access roads to pits, quarries or stockpiles shall be adequately bridged or culverted where they cross brooks or streams.

The Contractor shall ensure that no silting of water courses occurs due to erosion of the pit or as a result of washing operations.

Any discharge of water, including washing water, containing more than 30 mg/[illegible] suspended solids, shall not be disposed of directly into a [illegible] course or water body. Silt laden water exceeding this limit shall be discharged to a vegetated area or to a sedimentation basin for removal of excess silt, before being disposed of into a water course or water body.

Hydrocarbon tanks shall be located at least 100 metres from a marsh or water body. Fuel tanks shall be emptied if operations close down for the winter.

Upon completion of operations, all equipment and unnatural features must be removed and the pit or quarry must be restored to the satisfaction of the Engineer and the Department of the Environment. Depending on the location, this restoration will include any or all of the following:

(1) sloping of the gravel pit faces to smooth, trim and stable grades

(2) revegetation of newly opened pits and extension of existing pits

(3) scaling down of quarry faces to remove all rocks and fragments liable to slide or roll down

(4) draining and filling in or any settling ponds or depressions which may become a hazard

(5) retrenching, or otherwise blocking off, the entrance to the pit or quarry. Entrance trenches or barriers shall be graded and trimmed to sightly proportions.

310.12 MEASUREMENT FOR PAYMENT

310.12.01 Measurement for Payment for Paving Aggregates and Concrete Aggregates

For paving aggregates or concrete aggregates no separate measurement for payment is normally made, since the paving aggregates or the concrete aggregates are usually paid for as part of the asphaltic mix or as part of the concrete, respectively.

However, should the contract item state; the supply of stockpiled paving aggregate, or the supply of stockpiled concrete aggregate then the material shall be measured for payment.

310.12.02 Measurement for Payment for Chip Seal Aggregate

For chip seal aggregate measurement for payment may be by; the amount of chip seal aggregate placed on the road, the area of treated road surface, or the amount of chip seal aggregate stockpiled.

310.12.03 Measurement for Payment for Selected Granular Base Courses

Measurement for payment for selected granular base courses may be by; the actual amount of selected granular base course placed in the work, the nominal amount of selected granular base course place in the work, or the amount of selected granular base course stockpiled.

310.12.04 Measurement for Payment for Winter Sand

Winter sand shall be measured for payment in accordance with the provisions of Section 217 "Winter Sand".

310.12.05 Measurement for Payment for Armour Stone and Rip-Rap Stone

Armour stone and stone used in rip-rap shall be measured for payment in accordance with the provisions of Section 810 "Armour Stone" and Section 818 "Rip-Rap Treatment".

310.12.06 Measurement for Payment for "Supply Rock Fill in Place", and "Supply Other Material Fill in Place"

Measurement for payment for "Supply Rock Fill in Place" and "Supply Other Material Fill in Place" shall be in accordance with the provisions of Section 204 "Grading of Fill".

310.12.07 Stockpiled Materials Weight Measurement for Payment

Where on the contract unit price table it states that aggregate or selected granular base course materials are to be stockpiled and the unit of measurement is stated in tonnes, then such materials shall be weighed on scales before being placed in stockpiles.

The scales shall be provided by the Contractor and conform with the requirements of Section 301 "Weighing Materials in Trucks". The Department will supply scale checkers and the Department Scale Checker will issue the tickets. Loads certified by the Department Road Checker as being placed in the stockpile shall be included in measurement for payment.

The weight shall be computed in tonnes, rounded to one decimal place.

310.12.08 Stockpiled Materials Volume Measurement for Payment

Where on the Contract Unit Price table it states that aggregate or selected granular base course materials are to be stockpiled and the unit of measurement is stated in cubic metres, then such stockpiles shall be cross sectioned and the volume computed in cubic metres rounded to the nearest whole number.

The quantity to be measured shall be the number of cubic metres of stockpiled material as shown on the cross section sheets between the graded base of the stockpile as cross sectioned before stockpiling begins and the cross sections made over the completed stockpile. The volume of this stockpile being computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

310.13 BASIS OF PAYMENT

310.13.01 Basis of Payment for Stockpiled Materials

Where a contract item in the Highway Unit Price Table specifies that a material be stockpiled, then the payment shall be at contract price per tonne or per cubic metre, as the case may be, for the appropriate type of stockpiled material. Such payment shall be full compensation for all labour, equipment-use, materials and any other expenses to; provide a pit or quarry, obtain all required permits and approval, provide and transport pit or quarry samples to the Department's Soils Laboratory in St. John's, clear, grub and strip the pit or quarry, process pit or quarry material to the required gradation and physical requirements, provide and maintain a field laboratory, provide scales if required, provide a site for the stockpile, provide an access road to stockpile, transport and place the material in the stockpile, clean up the pit or quarry, pay any royalties for the material, and provide such other restoration to the pit or quarry as may be required.

In the particular case of stockpiling chip seal aggregate the basis of payment shall also include washing the chip seal aggregate before it is placed in the stockpile.

However, no payment will be made for; stockpiled asphalt aggregate, stockpiled chip seal aggregate, or stockpiled selected granular base course, where the provision of the stockpile is part of the Contractor's operations prior to processing or placing the material and where there is no separate contract item specifying the stockpiled material.

310.13.02 Basis of Payment for Aggregates and Select Granular Base Courses

Where paving aggregates, chip seal aggregates, concrete aggregates, select granular base courses and select bedding for storm sewers is placed in the work, then payment will be in accordance with the provisions of the appropriate specification for the item.

310.13.03 Basis of Payment for Armour Stone and Rip-Rap Stone

The basis of payment for armour stone and rip-rap stone shall be in accordance with the provisions of Section 615 "Armour Stone" and Section 616 "Rip-Rap Treatment".

310.13.04 Basis of Payment for "Supply Rock Fill in Place", and "Supply Other Material Fill in Place"

The basis of payment for "Supply Rock Fill in Place" and "Supply Other Material Fill in Place" shall be in accordance with the provisions of Section 204 "Grading of Fill".

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SECTION 317

WINTER SAND

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317.07 BASIS OF PAYMENT

317.01 SCOPE

This specification covers the requirements for the supply and delivery of winter sand.

317.02 PHYSICAL AND GRADATION REQUIREMENTS

Materials shall be natural or manufactured from natural aggregates and consist of sound and durable predominately angular particles completely resistent to breakdown under traffic or freezing conditions.

Materials shall be composed of clean, hard uncoated particles and shall be free from organic matter, clay lumps, and deleterious materials such as shale, salts, ochre and schists.

Materials shall conform to the gradation requirements as given in Table 1. The gradation shall not show marked fluctuations from opposite extremes of the limiting sizes and the plotted curve shall flow in a manner free from acute changes in direction.

TABLE #1, GRADATION REQUIREMENTS

Sieve Sizes	% Passing by Dry Weight
12.7 mm	100
4.75 mm	70-95
2.00 mm	50-80
0.425 mm	5-25
0.075 mm	0-6

317.03 SAMPLING AND INSPECTION

Materials shall be sampled and inspected by the Department of Transportation prior to stockpilinig at the designated locations. This acceptance shall not preclude further stockpile sampling, which may or may not lead to material rejection.

The quantity of these tests shall be determined by the Engineer. They shall be sufficient in number to provide an acceptable product.

317.04 USE OF PITS AND STOCKPILES

The use of pits for the production of Winter Sand, together with the requirements for the stockpiling of the Winter Sand, shall be in compliance with the provisions of Section 310 "Use of Pits, Quarries and Stockpiles".

[illegible]

The work shall be carried out in accordance with the environmental provisions of Section 310 "Use of Pits, Quarries and Stockpiles".

317.06 MEASUREMENT FOR PAYMENT

The measurement for payment will only be for those materials accepted for use under this specification.

Where the contract unit price table states that Winter Sand is to be stockpiled and paid for in cubic metres, then such stockpiles shall be cross-sectioned and the volume computed in cubic metres rounded to the nearest whole number.

The quantity to be measured shall be the [illegible] metres of stockpiled Winter Sand as shown on the [illegible] sheets between the graded base of the stockpile as [illegible] sectioned before stockpiling begins and [illegible] made over the completed stockpile. The volume of [illegible] being computed by the average end area method of computation or as wedges of pyramids, as the case may be when terminating at grade points.

317.07 BASIS OF PAYMENT

Payment at the contract price per cubic metre for Winter Sand shall be full compensation for all labour, equipment-use, materials and any other expenses to; provide a pit, obtain environmental approval, provide and transport pit samples to the Department's Soils Laboratory in St. John's, clear, grub and strip the pit, process pit material to the required gradation and physical requirements, transport and place the material in the stockpile, clean up the pit, pay any royalties for the material, and provide such other restoration to the pit as may be required.

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SECTION 320

TACK COAT

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320.08 BASIS OF PAYMENT

320.01 SCOPE

This section covers the requirements for the supply and application of Tack Coat to pavement surfaces prior to re-paving with asphaltic concrete.

320.02 MATERIALS

The Contractor has the option of using either type RC-70 cut back asphalt or a solution of type SS-1h emulsified asphalt, as the tack coat material, or other materials approved by the engineer.

(i) Type RC-70 cut back asphalt shall conform to A.S.T.M. D2028-76.

(ii) Type SS-1h emulsified asphalt shall conform to A.S.T.M. D977-80. Water for forming the solution with the SS-1h shall be clean water free from impurities. The Contractor shall supply his choice of tack coat materials.

320.03 EQUIPMENT

Tack Coat shall be applied by means of an approved pressure distributor equipped with thermometer, pressure gauge, fifth wheel tachometer and suitable spray nozzles which shall all be of the same orifice and manufacturer and capable of producing a fog-type spray. The slot of each nozzle shall be set at 30 degrees to the axis of the spray bar and the spray bar shall be set at a height above the existing pavement that will permit the fan from each nozzle to overlap its neighbouring fan by exactly half.

320.04 APPLICATION

Tack Coat shall only be placed on surfaces that are clean and dry and then only when the atmospheric temperature is at least 10°C.

Should the surface to be treated be dirty, then the Contractor shall thoroughly clean the surface by means of a power broom, or equivalent.

Tack Coat shall only be placed on surfaces that have been approved by the Engineer.

The Contractor shall plan his work so that no more tack coat than is necessary for the days paving operation is applied at one time.

To avoid nuisance and possible property damage to the travelling public, the Contractor shall install portable traffic lights or other means of directing one-way traffic while the Contractor is working on the adjacent part of the road.

320.04.01 Special Application Requirements for Type RC-70 Tack Coat

The type RC-70 tack coat shall be applied at a temperature between 38°C and 80°C, at a rate of 0.25 L/m2.

320.04.02 Special Application Requirements for Type SS-1h Emulsion Tack Coat

The type SS-1h emulsion shall be diluted with an equal volume of water prior to the application. The diluted SS-1h emulsion shall be applied at a rate of 0.5 L/m2 of diluted emulsion.

Both the mixing temperature and the application temperature shall be between 20°C and 50°C.

320.05 ENVIRONMENTAL PROVISIONS

Should any tack coat spill larger than 70 L occur, then the spill shall be immediately reported to the Department of Environment. Contractors should verbally report the spill via the Canadian Coast Guard (telephone collect 737-2882).

The Contractor shall take such steps as are necessary to abate the discharge, clean up the area affected, dispose of waste materials in an approved waste disposal site, and restore the environment to the satisfaction of the Department of Environment, all at the Contractor's expense.

320.06 CURING

No hot mix shall be placed upon the tack coat until it has dried to a proper condition of tackiness, as determined by the Engineer. The Contractor is advised that the period required for such drying will depend upon weather conditions; it will normally be about 24 hours for type RC-70 tack coat and 1 to 2 hours for type SS-1h emulsion tack coat.

320.07 MEASUREMENT FOR PAYMENT

Measurement for payment shall be by means of the horizontal area actually treated with tack coat lying within the area designated by the Engineer for treatment. The area shall be computed in square metres, rounded to one decimal place.

320.08 BASIS OF PAYMENT

Payment at the contract price for Tack Coat shall be compensation in full for all labour, materials and equipment-use to; clean the existing surface, supply and apply the tack coat, together with the provision of portable traffic lights, if required.

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SECTION 330

HOT MIX ASPHALTIC CONCRETE

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330.01 SCOPE

This specification covers the Department's requirements for the production, placing and compaction of hot mix, hot laid asphaltic base course and asphaltic surface course asphaltic concrete for pavement construction. Also covered are the requirements for asphaltic levelling course to fill pavement depressions.

The base and surface course asphaltic concrete pavement shall consist of asphaltic cement, coarse and fine mineral aggregate plus mineral filler if required, combined as hereinafter specified, placed and compacted on a prepared base in conformity with the lines, grades, dimensions and cross-sections, as staked by the Engineer.

330.02 MATERIALS

330.02.01 Mixture Materials

330.02.01.01 Asphalt Cement

Unless otherwise specified, asphalt cement shall conform to the requirements of ASTM D 946-82 for 150/200 penetration grade asphalt.

The Contractor shall obtain from the manufacturer and furnish to the Department, in tabular or graphic form, the temperature — viscosity relationship of the asphalt cement to be used.

Should the contract item description in the Unit Price Table contain the phrase "including asphalt cement", then the Contractor shall supply the asphalt cement.

However, should the contract item description not contain the aforementioned phrase, then the Department will supply all the required asphalt cement free to the Contractor at Newfoundland Hardwoods plant at Clarenville or Stephenville. The Contractor shall be responsible for the arranging of delivery and all costs involved in the delivery of the asphalt cement and its storage at the job site.

330.02.01.02 Coarse Aggregate

Coarse aggregate shall consist of hard, durable crushed stone particles or crushed gravel particles reasonably uniform in quality throughout and free from soft or disintegrated pieces. The portion of the material retained on the 4.75 mm sieve shall be known as coarse aggregate. Gravel shall be washed if necessary to have clean surfaces free from coatings of foreign matter.

Coarse Aggregates shall conform to the physical requirements shown in Table 1.

TABLE 1

PHYSICAL REQUIREMENTS FOR COARSE AGGREGATES

Los Angeles Abrasion* (Loss % Maximum)	ASTM C131-81	35
Absorption (% Maximum)	ASTM C 127-81	2
Bulk Specific Gravity (Minimum)	ASTM C127-81	2.20
Soundness-Magnesium Sulphate - 5 cycles (Loss % Maximum)	ASTM C88-76	15
Crushed Particles (% Minimum)		70
Flat and Elongated** Pieces (% Maximum)		10
Loss by Washing (% Maximum Passing 0.075 mm sieve)	ASTM C117-80	2

* Material with an abrasion ratio higher than 0.285, for 100-500 revolutions shall not be used without the written permission of the Engineer.

** Flat and elongated pieces are those whose greatest dimension exceeds four times their least dimension.

In addition to the requirements of Table 1, coarse aggregate proposed for use in surface course pavement will not be acceptable if more than 1% of the particles (expressed as a percentage of the weight of material retained on the 4.75 mm sieve), absorbs more than 5% by weight of water.

The aggregates shall be of such nature that a thorough coating of asphalt cement will not strip off upon contact with water as determined by the Standard Method of Test for Coating and Stripping of Bitumen-Aggregate Mixtures (ASTM D 1664-80)

Irrespective of compliance with the physical requirements of Table 1, any aggregate may be accepted or rejected on the basis of past field performance.

Coarse aggregates shall be supplied by the Contractor.

330.02.01.03 Fine Aggregate

Fine aggregate shall consist of clean, tough, rough-surfaced grains, free from clay, loam and other foreign matter. As delivered to the mixer it shall be free from clayey lumps or loosely bonded aggregations, and the individual particles shall be free from adhering dust. The portion of the material passing the 4.75 mm sieve shall be known as fine aggregate.

The aggregates shall be of such nature that a thorough coating of asphalt cement will not strip off upon contact with water as determined by the Standard Method of Test for Coating and Stripping of Bitumen-Aggregate Mixtures (ASTM D 1664-80).

The physical requirements in Table 1 for Coarse Aggregates shall also apply to fine aggregates for abrasion, absorption, bulk specific gravity and soundness.

Any aggregate may be accepted or rejected on the basis of past field performance.

Fine aggregates shall be supplied by the Contractor.

330.02.01.04 Blending Sand

Blending sand shall consist of clean, tough, rough surfaced grains, free from clay, loam, or any other foreign matter. Blending sand shall be supplied by the Contractor.

330.02.01.05 Mineral Filler

Where sufficient material passing the 75 µm sieve is not available in the aggregate the Contractor shall supply mineral filler approved by the Engineer at no extra cost to the Department.

Mineral filler shall consist of thoroughly dry stone dust, portland cement, or other artificially or naturally powdered material dust, 65% to 100% of which will pass a 75 µm sieve.

330.02.02 Composition of Mixture

330.02.02.01 General Requirements for Mixture

The composition of the mixture shall be designated by the Engineer. The mixture shall consist of uniformly graded fine and coarse aggregate and thoroughly mixed with asphalt cement as specified. Blending sand, mineral filler and chemical additives shall be added when required.

Unless otherwise specified, the aggregates shall be combined in such proportions as to produce a mixture conforming to the grading and asphalt content requirements of Table 2.

TABLE 2

ASPHALT AGGREGATE MIXTURES

Sieve Size	Percent Passing by Dry Weight	
	Base Course	Surface Course
19.0 mm	100	100
12.5 mm	80-100	97-100
4.75 mm	35-75	55-75
2.00 mm	20-60	35-55
425 µm	10-35	18-30
75 µm	0-8	0-8
Asphalt Content (% by weight of total) mixture	5.0-7.0	5.5-7.5

Once an acceptable aggregate gradation is achieved in the crushing operation, the tolerances for subsequent production are as follows:

Tolerance for Production of Asphalt Aggregate

Aggregate Passing 4.75mm sieve	± 5%
Aggregate Passing 5.00mm sieve & 425 µm sieve	± 4%
Aggregate Passing 75 µm sieve	± 2%

Aggregate gradation and asphalt cement content of the mixture shall be as specified in the approved mix design. Asphalt cement contents varying from that specified in the mix design by more than 0.25% shall be unacceptable.

Asphaltic Levelling Course shall consist of asphaltic surface course asphaltic concrete, except on those projects where there is no item for Asphaltic Surface Course, in which case Asphaltic Base Course may be used instead.

330.02..02.02 Physical Requirements for Mixture

The aggregates and the asphalt cement shall be mixed in such proportions as to satisfy the criteria contained in Table 3. These criteria are based on the Standard Marshall Test Procedures and using a compactive effort of 75 blows on each face of the specimen, or other compactive effort found necessary during the mix design.

TABLE 3

PHYSICAL REQUIREMENTS — BASE AND SURFACE COURSE PAVING MIXTURES

	Min.	Max.
Marshall Stability kg. at 60°C	450	—
Marshall Flow Index units of 0.25 mm	10	20
% Air Voids	3	5
% Voids in Compacted Mineral Aggregate	15	—

330.02.02.03 Designation of Mixture

The Engineer shall specify or approve a job mixture within the required limits of grading and conforming to the Marshall Test requirements given in Table 3 for each mix selected. The Engineer may select one or more mix proportions to suit job conditions. The actual grading of the job mix, when plotted, shall so range from coarse through fine sizes that it will approximate the shape of the plotted average grading for corresponding mix given in Table 2. For that portion of the aggregate passing the 4.75 mm sieve, gradings which range from the maximum of one sieve to the minimum of the next larger sieve, shall not be permitted.

330.02.02.04 Unauthorized Tampering with Plant Settings & Materials

Any person employed by the Contractor, who, in the opinion of the Engineer, alters or causes to be altered, any settings or screens of an asphalt plant after it has been calibrated, or who adds or causes to be added, any unapproved material to a stockpile or aggregate, or in any way hampers the production of the mix as designed, shall at the written request of the Engineer, be forthwith removed from the project and such persons shall not again be employed in the work.

330.03 USE OF PITS, QUARRIES AND STOCKPILES

The use of pits and quarries for the production of the aggregates, together with the requirements for the stockpiling of the aggregates shall be in compliance with the provisions of Section 310 "Use of Pits, Quarries and Stockpiles For Production of Materials Supplied by Contractor".
Should the Contractor intend to use a Drum Mixer Asphalt Mixing Plant, then the designated aggregates shall be split on the 6.35 mm screen and each material shall be stockpiled separately such that intermixing of each size and type does not occur. The course aggregate stockpile shall contain no more than 15% passing the 6.35 mm screen.

330.04 ENVIRONMENTAL [illegible]

Pits and quarries shall be stripped, worked and at the completion of the work restored, all in compliance with the provisions of Section 310 "Use of Pits, Quarries and Stockpiles for Production of Materials Supplied by Contractor".
Off-specification asphalt must be discarded at an approved waste disposal site with the consent of the owner/operator of the site or completely buried as directed by the Engineer. Information on these sites can be obtained from the Department of Environment.

Fine aggregates shall be supplied by the Contractor.

330.02.01.04 Blending Sand

Blending sand shall consist of clean, tough, rough surfaced grains, free from clay, loam, or any other foreign matter. Blending sand shall be supplied by the Contractor.

330.02.01.05 Mineral Filler

Where sufficient material passing the 75 µm sieve is not available in the aggregate the Contractor shall supply mineral filler approved by the Engineer at no extra cost to the Department.

Mineral filler shall consist of thoroughly dry stone dust, portland cement, or other artificially or naturally powdered material dust, 65% to 100% of which will pass a 75 µm sieve.

330.02.02 Composition of Mixture

330.02.02.01 General Requirements for Mixture

The composition of the mixture shall be designated by the Engineer. The mixture shall consist of uniformly graded fine and coarse aggregate and thoroughly mixed with asphalt cement as specified. Blending sand, mineral filler and chemical additives shall be added when required.

Unless otherwise specified, the aggregates shall be combined in such proportions as to produce a mixture conforming to the grading and asphalt content requirements of Table 2.

TABLE 2

ASPHALT AGGREGATE MIXTURES

Sieve Size	Percent Passing by Dry Weight	
	Base Course	Surface Course
19.0 mm	100	100
12.5 mm	80-100	97-100
4.75 mm	35-75	55-75
2.00 mm	20-60	35-55
425 µm	10-35	18-30
75 µm	0-8	0-8
Asphalt Content (% by weight of total) mixture	5.0-7.0	5.5-7.5

Once an acceptable aggregate gradation is achieved in the crushing operation, the tolerances for subsequent production are as follows:

Tolerance for Production of Asphalt Aggregate

Aggregate Passing 4.75mm sieve	± 5%
Aggregate Passing 5.00mm sieve & 425 µm sieve	± 4%
Aggregate Passing 75 µm sieve	± 2%

Aggregate gradation and asphalt cement content of the mixture shall be as specified in the approved mix design. Asphalt cement contents varying from that specified in the mix design by more than 0.25% shall be unacceptable.

Asphaltic Levelling Course shall consist of asphaltic surface course asphaltic concrete, except on those projects where there is no item for Asphaltic Surface Course, in which case Asphaltic Base Course may be used instead.

330.02.02.02 Physical Requirements for Mixture

The aggregates and the asphalt cement shall be mixed in such proportions as to satisfy the criteria contained in Table 3. These criteria are based on the Standard Marshall Test Procedures and using a compactive effort of 75 blows on each face of the specimen, or other compactive effort found necessary during the mix design.

TABLE 3

PHYSICAL REQUIREMENTS — BASE AND SURFACE COURSE PAVING MIXTURES

	Min.	Max.
Marshall Stability kg. at 60 °C	450	—
Marshall Flow Index units of 0.25 mm	10	20
% Air Voids	3	5
% Voids in Compacted Mineral Aggregate	15	—

330.02.02.03 Designation of Mixture

The Engineer shall specify or approve a job mixture within the required limits of grading and conforming to the Marshall Test requirements given in Table 3 for each mix selected. The Engineer may select one or more mix proportions to suit job conditions. The actual grading of the job mix, when plotted, shall so range from coarse through fine sizes that it will approximate the shape of the plotted average grading for corresponding mix given in Table 2. For that portion of the aggregate passing the 4.75 mm sieve, gradings which range from the maximum of one sieve to the minimum of the next larger sieve, shall not be permitted.

330.02.02.04 Unauthorized Tampering with Plant Settings & Materials

Any person employed by the Contractor, who, in the opinion of the Engineer, alters or causes to be altered, any settings or screens of an asphalt plant after it has been calibrated, or who adds or causes to be added, any unapproved material to a stockpile or aggregate, or in any way hampers the production of the mix as designed, shall at the written request of the Engineer, be forthwith removed from the project and such persons shall not again be employed in the work.

330.03 USE OF PITS, QUARRIES AND STOCKPILES

The use of pits and quarries for the production of the aggregates, together with the requirements for the stockpiling of the aggregates shall be in compliance with the provisions of Section 310 "Use of Pits, Quarries and Stockpiles For Production of Materials Supplied by Contractor".

Should the Contractor intend to use a Drum Mixer Asphalt Mixing Plant, then the designated aggregates shall be split on the 6.35 mm screen and each material shall be stockpiled separately such that intermixing of each size and type does not occur. The course aggregate stockpile shall contain no more than 15% passing the 6.35 mm screen.

330.04 ENVIRONMENTAL PROVISIONS

Pits and quarries shall be stripped, worked and at the completion of the work restored, all in compliance with the provisions of Section 310 "Use of Pits, Quarries and Stockpiles for Production of Materials Supplied by Contractor".

Off-specification asphalt must be discarded at an approved waste disposal site with the consent of the owner/operator of the site or completely buried as directed by the Engineer. Information on those sites can be obtained from the Department of Environment.

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SECTION 401

DITCHING FOR STREA [redacted]

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401.02 MEASUREMENT FOR PAYMENT
401.03 BASIS OF PAYMENT

401.01 DESCRIPTION

All stream ditches pertaining to the drainage of the highway, whether within the limits of the right of way or not, shall be considered part of the contract. All materials excavated from ditches if suitable for constructing roadway fills shall be incorporated into fill construction in accordance with Section 204 "Grading of Fill". Materials not suitable for roadway fills shall be deposited in flat waste banks where and as directed by the engineer and shall be levelled and trimmed to sightly proportions and contours to the engineer's satisfaction.

In swamps, bogs and other wet areas the contractor if he so desires may excavate ditches to the satisfaction of the engineer by the use of ditching dynamite.

The term "Ditching for Streams" will include all excavations lying beyond the actual ends of footings for culverts and other drainage structures, and will include excavations for stream diversions.

[redacted]

[redacted]

[redacted]

The Contractor shall excavate the ditches to the lines, grades and cross section limits staked by the Engineer.

[redacted]

401.02 MEASUREMENT FOR PAYMENT

Measurement will be made in excavation and will be from the cross-section sheets showing the original ground lines and the completed and accepted excavation lines as cross-sectioned. The volume of this excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

Excavation below grade, or beyond the cross-section limits staked will not be measured for payment.

No allowance will be made for material excavated before original cross-sections have been made.

The volume for payment shall be measured in cubic metres, rounded to the nearest whole number.

401.03 BASIS OF PAYMENT

Payment shall be at the Contract Unit Price per cubic metre for either Ditching for Streams, Solid Rock, hauled 1 km or under, or Ditching for Streams, Other Material hauled 1 km or under, as the case may be, and such payment will be compensation in full for all labour and materials required to carry out the operations herein described.

However, where the Engineer requires that materials excavated from ditches be hauled in excess of the 1 km freehaul before being placed, additional payment for overhaul will be made in accordance with Section 215 "Overhaul on Excavation Materials".

Department of
Transportation
NEWFOUNDLAND

SECTION 403

EXCAVATION FOR FOUNDATIONS

INDEX

403.01 DESCRIPTION
403.02 CLASSIFICATION
403.03 MEASUREMENT FOR PAYMENT
403.04 BASIS OF PAYMENT

403.01 DESCRIPTION

This work shall include labour and materials required to carry out excavation such as that required to obtain a foundation for such structures as culverts, footings and gabions, and shall include hauling up to 1 km, handling and incorporation of all suitable materials into fill construction in accordance with Section 204 "Grading of Fill", and shall include the hauling up to 1 km, and handling of the unsuitable materials and the trimming of such unsuitable materials along embankment slopes or elsewhere, all as directed by the Engineer.

The Contractor shall excavate along the lines, to the width and to the grade required by the Engineer.

In the particular case of excavation for foundations for culverts the Contractor will normally only be required to excavate for a width equal to the nominal diameter of the pipe, or the nominal span of [illegible] of arches, plus a distance of [illegible] on each side of the culvert, unless required otherwise by the Engineer.

When a footing is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation. In soft or wet conditions, the final removal of material to foundation level shall not be made until the Contractor is ready to proceed with the construction of the footing.

403.02 CLASSIFICATION

Excavated materials will be classified as either "Solid Rock" or "Other Material" in accordance with Section 205 Classification of Excavated Materials.

403.03 MEASUREMENT FOR PAYMENT

Volumes of all classes of excavation described in 403.02 Classification will be measured in excavation and computed in cubic metres rounded to the nearest whole number. Measurements shall be of the actual amount of material moved from within the limits required by the Engineer.

The quantity to be measured shall be the number of cubic metres of excavated material as shown between the position of the ground lines as cross-sectioned after grubbing operations have been completed (or when excavation for foundation is to be carried out in a cut, after grading of cut operations have been completed), and the completed and accepted excavation lines. Material excavated outside of the required limits will not be included in measurement for payment. The volume of the excavation to be computed by the average end area method of computation or as wedges or pyramids, as the case may be, when terminating at grade points.

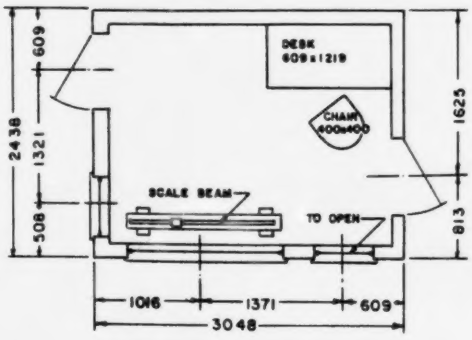
During excavation operations whenever the character of material changes from one type to another, as classified in Section 205, then the Contractor shall strip the area, within the limits, of all overlying material, and notify the Engineer in order that proper measurements or cross-sections may be made. No allowance will be made for material excavated before such measurements or cross-sections have been made.

For boulders present in Other Material; the three maximum rectilinear dimensions of boulders, actually excavated, will be measured and the volume of each so determined. Volumes of the boulders which are equal to, or greater than, zero decimal five cubic metres will be included for payment as Excavation for Foundation Solid Rock.

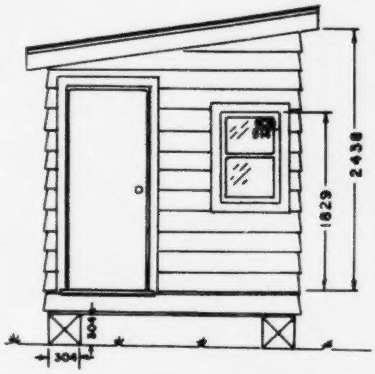
403.04 BASIS OF PAYMENT

Payment shall be at the Contract Unit Price per cubic metre for Excavation For Foundation, Solid Rock or Other Material, as the case may be, hauled 1 km or under. Such payment shall be full compensation for all work herein described together with the labour, materials and equipment-use required for excavating, handling, hauling up to 1 km and placing and compacting in a fill as described in Section 204 "Grading of Fill".

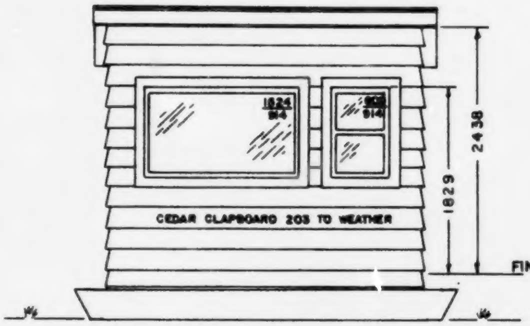
Where the Engineer requires that Excavation for Foundation material be hauled in excess of 1 km, additional payment for overhaul will be made in accordance with Section 215 "Overhaul on Excavated Materials".


DESK
609 x 1219
CHAIR
400 x 400
SCALE BEAM
TO OPEN
609
1321
508
2438
1625
813
1016
1371
609
3048

FLOOR PLAN

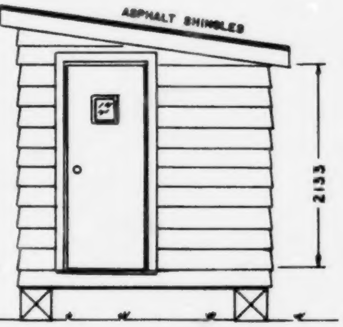

2438
1829
304
304

LEFT SIDE ELEVATION


1524
914
902
914
CEDAR CLAPBOARD 203 TO WEATHER
2438
1829

FIN.FL.

FRONT ELEVATION


ASPHALT SHINGLES
2133

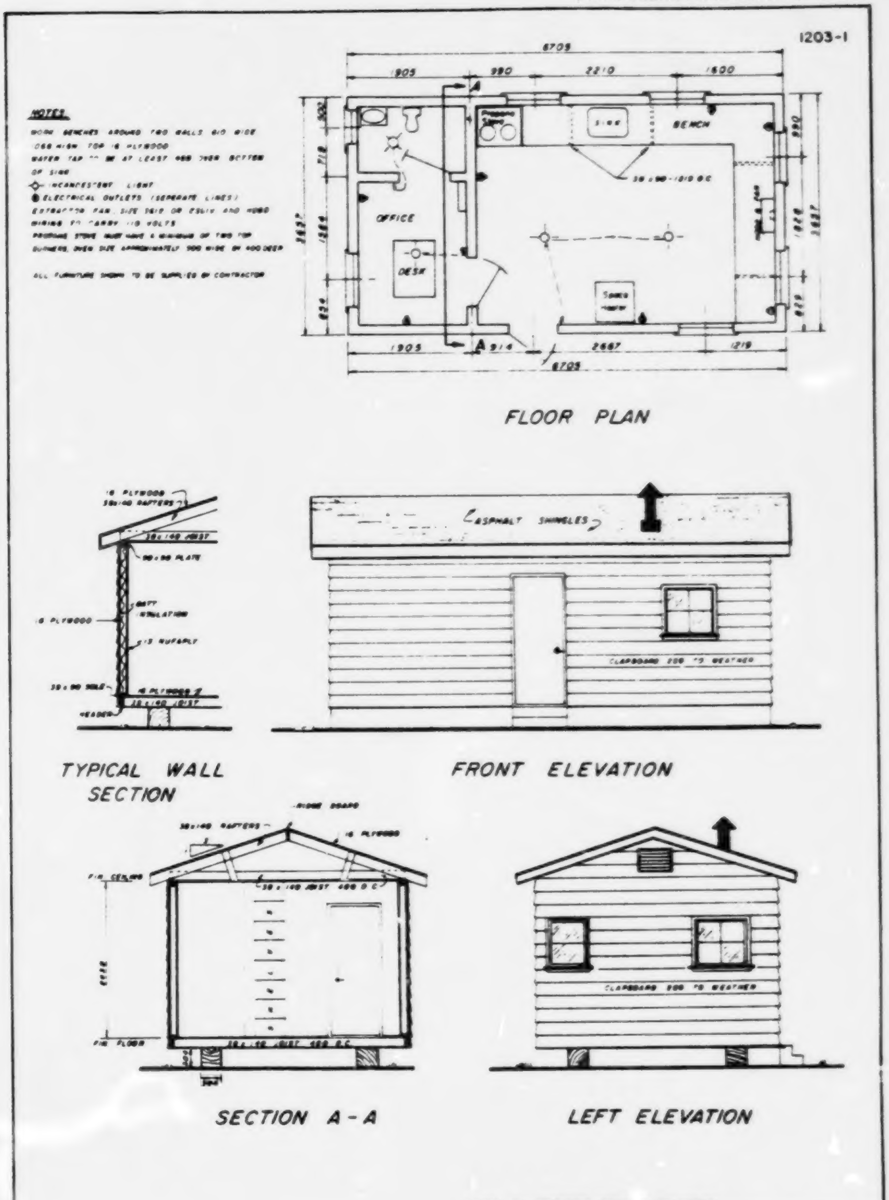
RIGHT SIDE ELEVATION

NOTE:- PROVISION FOR HEATING AND LIGHTING SHALL BE MADE BY CONTRACTOR.

NOTE — ALL DIMENSIONS SHOWN IN MILLIMETRES.

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS PORTABLE SCALE HOUSE	
DRAWN BY: KAP	DATE: 79-03-16
CHECKED BY:	SCALE 1:50

1203-1


6705
1905
990
2210
1600
A
OFFICE
DESK
SINK
BENCH
Space heater
2637
1905
914
2667
1219
6705
FLOOR PLAN
16 PLYWOOD
38x140 RAFTERS
38x140 JOIST
90x90 PLATE
BATT INSULATION
16 PLYWOOD
38x90 SOLE
HEADER
ASPHALT SHINGLES
CLAPBOARD 200 TO WEATHER
TYPICAL WALL SECTION
FRONT ELEVATION
RIDGE BOARD
38x140 RAFTERS
16 PLYWOOD
FIN. CEILING
38x140 JOIST 400 O.C.
FIN. FLOOR
CLAPBOARD 200 TO WEATHER
SECTION A-A
LEFT ELEVATION

NOTES

WORK BENCHES AROUND TWO WALLS 610 WIDE 1066 HIGH TOP 16 PLYWOOD

WATER TAP TO BE AT LEAST 450 OVER BOTTOM OF SINK

◇ INCANDESCENT LIGHT

● ELECTRICAL OUTLETS (SEPERATE LINES)

EXTRACTOR FAN, SIZE 1610 OR ESLIV AND HOOD

WIRING TO CARRY 110 VOLTS

PROPANE STOVE MUST HAVE A MINIMUM OF TWO TOP BURNERS, OVEN SIZE APPROXIMATELY 500 WIDE BY 400 DEEP

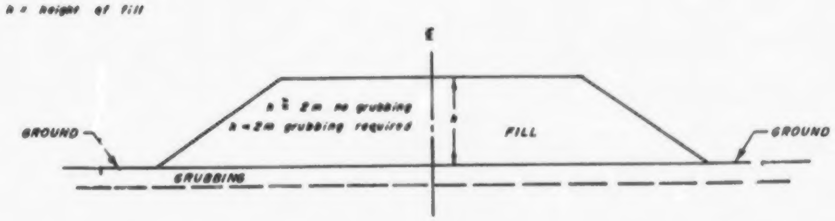
ALL FURNITURE SHOWN TO BE SUPPLIED BY CONTRACTOR

(NOTE) ALL DIMENSIONS SHOWN IN MILLIMETRES

DEPARTMENT OF TRANSPORTATION

FIELD LABORATORY

DRAWN BY H.O.A.	DATE MAY 30, 1978
CHECKED BY.	SCALE 1:50


h = height of fill
℄
h ≥ 2m no grubbing
h < 2m grubbing required
h
FILL
GROUND
GROUND
GRUBBING

NOTE:

1.) IF FILL IS HIGHER THAN, OR EQUAL TO 2 m, THEN DO NOT GRUB

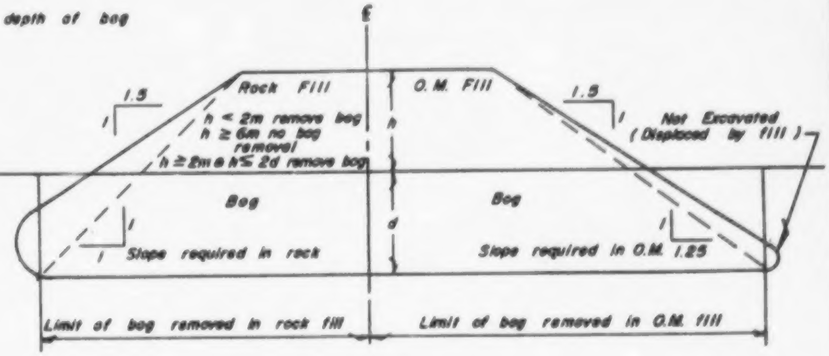
2.) IF FILL IS LOWER THAN 2 m, THEN GRUB

PROVINCE OF NEWFOUNDLAND
DEPARTMENT OF TRANSPORTATION

GUIDE LINES FOR GRUBBING

Scale N.T.S. Date 80-11-13

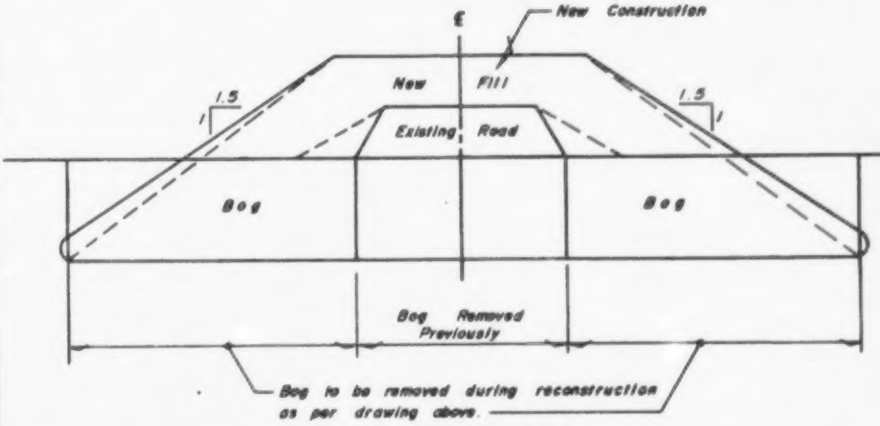
h = height of fill
d = depth of bog


℄
Rock Fill
O.M. Fill
1.5
1
1.5
1
h < 2m remove bog
h ≥ 6m no bog removal
h ≥ 2m & h ≤ 2d remove bog
h
Not Excavated (Displaced by fill)
Bog
Bog
d
1
1
Slope required in rock
1
Slope required in O.M. 1.25
Limit of bog removed in rock fill
Limit of bog removed in O.M. fill

NEW CONSTRUCTION

NOTES FOR BOG REMOVAL

1.) If fill is lower than 2 m, then remove bog
2.) If fill is higher than or equal to 2 m, and if fill is lower than or equal to twice the depth of bog, then remove bog.
3.) If fill is higher than or equal to 6 m, do not remove bog.


℄
New Construction
New Fill
1.5
1
1.5
1
Existing Road
Bog
Bog
Bog Removed Previously
Bog to be removed during reconstruction as per drawing above.

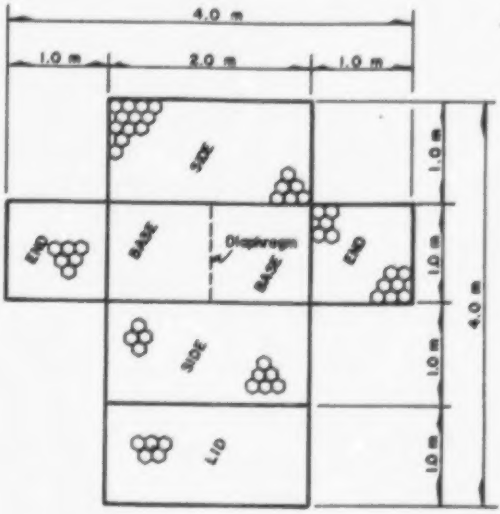
RECONSTRUCTION

PROVINCE OF NEWFOUNDLAND
DEPARTMENT OF TRANSPORTATION

GUIDE LINES FOR
BOG REMOVAL

Scale N.T.S.
Date 80-11-13

FORM 1210 JANUARY, 1982
1210-1



GABION PLAN

NOTES:

1.) Gabions shall be made of zinc coated steel wire, triple twisted, forming a uniform hexagonal mesh pattern of 80 x 100 mm opening.

2.) Galvanized wire shall be 2.9mm diameter

3.) Gabions shall be supplied folded flat to facilitate handling and transportation. They shall form rectangular baskets of specified sizes when constructed.

4.) When the gabion length exceeds its width, it shall be supplied with securely tied diaphragms connected to the base with material of the same composition as the gabion, to form individual cells of equal length and width.

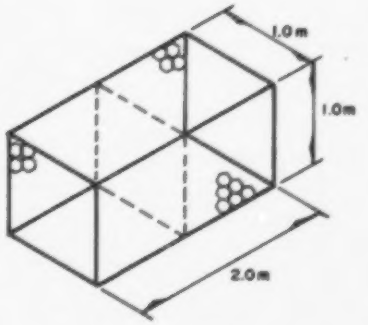
5.) The edges of the gabion shall be manufactured into securely connected selvages to prevent ravelling.

6.). The selvage or perimeter wire shall be made of 3.8mm galvanized wire.

7.). Tying and connecting wire of galvanized 2.1mm shall be supplied in the amount of not less than 8 % (Eight Percent) of the weight of the basket.

8.) Zinc coating 0.26 kg/m²

TYPE "A"



ISOMETRIC

PROVINCE OF NEWFOUNDLAND
DEPARTMENT OF TRANSPORTATION

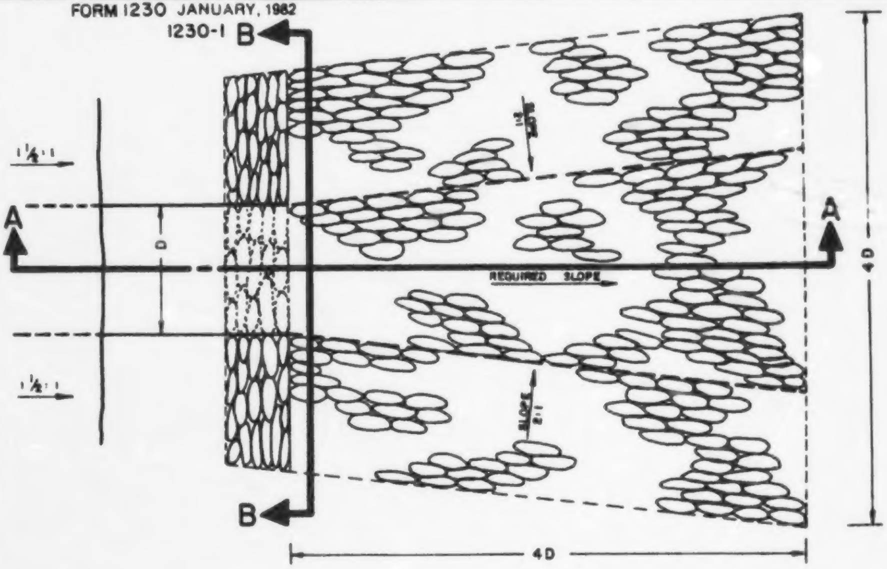
TYPICAL GABION

1.0m x 1.0m x 2.0m

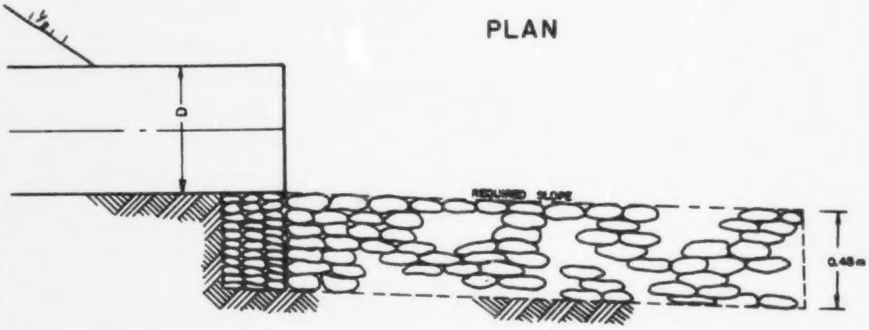
Scale 1:50	Drawn by T.K.T.	Date 80-08-11

FORM 1230 JANUARY, 1982

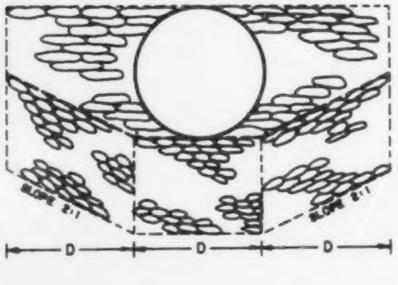
1230-1


B
B
1¼:1
1½:1
A
A
D
REQUIRED SLOPE
SLOPE
SLOPE 2:1
4D
4D

PLAN


1½:1
D
REQUIRED SLOPE
0.45m

SECTION A - A


SLOPE 2:1
SLOPE 2:1
D
D
D

SECTION B-B

PROVINCE OF NEWFOUNDLAND
DEPARTMENT OF TRANSPORTATION

RIP - RAP TREATMENT
FOR
STORM SEWER OUTLET

SCALE N.T.S	DATE 79-10-10